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ELECTRICAL WORLD AND ENGINEER.

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THE GAS ENGINE AT THE ST. LOUIS EXPOSITION.

What promises to be one of the most interesting and important features of the St. Louis Exposition is the section that will be devoted to gas engines and gas engine producers. European manufacturers appear to have arrived at the conclusion that this country affords an excellent field for this class of prime-mover, and at least two of the leading makers have taken large space for exhibits. One of these is the celebrated Cockerill Company, of Seraing, Belgium, which will exhibit a 3,000-hp engine of the type utilizing blast furnace gas. A 600-hp gas engine of this type exhibited by the Cockerill Company at Paris in 1900 was generally considered one of the "clous" of that exposition. Another is the well-known Borsig Company, of Tegel, Germany, which will show a 1,500-hp Oechelhauser engine operated from a Pintsch gas producer plant of 2,400-hp capacity. In addition to this producer plant will be one from England of 3,000-hp capacity and a Wood American plant of 2,000-hp capacity. In Europe the gas engine for some time has occupied the place before the engineering public that the steam turbine has lately assumed in this country, and the faith in its future is indicated by the great expense which manufacturers there are willing to incur in seeking publicity for its merits. In view of this situation we hope that American gas engine and gas producer manufacturers will not allow themselves to be left in the background at St. Louis.

HIGH-SPEED SENSATIONS.

At the beginning of the last century, the Royal College of Bavarian Physicians sought to forbid steam railway travel, because it would induce delirium furiosum among the passengers and drive the spectators crazy; while an English quarterly said that it would as soon expect the people to suffer themselves to be tied to one of Congreve's rockets as to trust themselves to the mercy of a locomotive going at the prodigious rate of twelve miles an hour. This is about the tenor of some of the remarks we see and hear in respect to the Berlin-Zossen electric train running at the rate of over 125 miles an hour; and we begin to wonder just what is the speed that ought to provoke mental and physical difficulties on the part of the passenger and the spectator. We fancy there is a good deal of relativity about it, and some subjectivity. If people expect to enjoy weird and curious sensations because they are traveling at an unusual rate, those are the very sensations they are likely to get; but if speed is steadily increased by a vehicle without the passenger being aware of the fact, a gain of twenty or even forty miles an hour will not make much perceptible difference to him, provided the run is straight and the roadbed is good.

In the reports coming from Germany, we note this tense expectancy and hence it is no surprise to hear that the speed at Zossen "confused the senses and produced a sensation that was unlike any that even the imagination had pictured. Had it not been for the steel edged-like spirals of air that shot through every crack and crevice, scorching and burning and even seeming to pierce the flesh, we might have been detached objects forced through space at lightning speed." Then, too, the landscape got blurred, with "a peculiar effect on the eyes, seeming to catch hold of them and drag them backward," which is very interesting; but this keen and sensitive observer rather gives himself away by remarking that the passengers, after squirming at an annihilation of distance past comprehension, "asked themselves why it might not have been 225 miles an hour just as well." Exactly; and we venture to believe that when the great electric railroad sys-

tems of the future settle down to their 200-miles-an-hour stride, or whatever the speed may be at which the vehicles will hold together, the passengers will take it very complacently and wonder how we antediluvians endured anything less.

The Electrolysis of Water Vapor.

A paper on this subject was read by Mr. F. A. Lidbury, at the recent convention of the American Electrochemical Society, which tends to show that electrolysis in gases may be a more complex process than electrolysis in liquids, so far as relates to the quantities of matter decomposed. The conclusion is drawn that in the partial decomposition of water vapor by electric discharges, the hydrogen and oxygen liberated tend to separate and to take up different positions in the tube, the hydrogen collecting at both anode and cathode, and the oxygen in the middle of the tube. This result is so anomalous by comparison with the action that takes place when discharges pass through water, instead of water vapor, that further experimental research should be directed to this matter. At first sight the result seems very improbable. In dealing with water vapor subjected to electric spark discharges, it has to be remembered that the heat of the discharge may be capable of decomposing the vapor into its constituent gases, and that complex results may occur when thermal dissociation is superposed upon electrolytic dissociation.

Electrical Supply for St. Louis.

There is no more disheartening and thankless task than taking in hand the aggregated blunders of past years and trying to rectify them into a homogeneous whole. The report which we publish elsewhere of the electrical situation in St. Louis is typical of the conditions found in many large cities, and discouraging as the combination might look at first sight, it will doubtless be worked into satisfactory shape in the end. We never look at such a situation without devoutly wishing that some extraneous potency might, without causing loss of life, or of other property, step in and wipe out of existence all the existing systems, leaving nothing but the task of reconstruction. Such a catastrophe would save money in the long run and would give a chance at last for the lighting of a large city to be arranged without damaging compromises. As the case now stands, St. Louis has a fairly good, but terribly heterogeneous group of systems which have wisely been united. Competition in the electrical supply of large cities is nearly always a cut-throat sort of business, when it really exists far from likely to result in the best of service and quite certain to injure the business by encouraging shifty rates. By gathering all the supply companies into one it will be possible to set and maintain fixed and equitable rates, probably lower than the average rates are now, and by economies in production and distribution to bring even from lowered rates a better return on the capital invested than is now obtainable.

The engineering of such a proposition is always fraught with difficulties, and particularly where the component factors operate on different systems and at different voltages, as is generally the case. The main existing networks are single-phase, three-wire, with 110 and 220 volts in the secondaries, and a direct-current, three-wire network at 235 and 470 volts. There are also 500-volt, direct-current motor circuits, series direct-current arc lights, and a miscellaneous lot of isolated plants waiting to be taken on. Out of this chaos some sort of organization must be brought. A new power house is under construction, to be equipped with large three-phase generators, the current from which will be distributed at 6,600 volts and used as may seem expedient. The engineers follow the practice of the day in adopting the 25-cycles, thereby crippling their power of utilizing the big generators directly; but they are at least in the fashion, and if five years from now there has to be a change, why the same old "necessary improvement" plea will probably again meet the emergency.

The International Electrical Congress of 1904 at St Louis.

The International Electrical Congress of St. Louis is now definitely outlined, and its success will largely depend upon the support that American electricians and electrical workers will lend to the movement. The International Electrical Congresses of the past have done much for the advance of the science and arts of electricity. The British Association for the Advancement of Science appointed a committee, in 1861, to report on the selection of electrical units. The committee reported from time to time up to 1874, formulating the centimetre-gramme-second, or C. G. S. system of units, and also the quadrant-eleventhet-gramme-second, or Q. E. S. system. The former was the fundamental scientific system, and the latter was a modification intended for practical use, with the ohm and volt as units. In 1881 (September 20), the first International Electrical Congress was held at Paris. It accepted and adopted the C. G. S. and Q. E. S. systems, created the farad, the ampere and the coulomb, and appointed a commission to redetermine the concrete value of the ohm. In 1884 another International Electrical Congress convened at Paris. It confirmed the volt, ampere, coulomb and farad and adopted a provisional concrete value for the ohm, called the legal ohm. A third International Electrical Congress was held at Paris in August, 1889. This congress created the joule and watt. It also defined the terms period, frequency, impedance, mean and effective currents and electromotive forces used in alternating-current technology. The next International Electrical Congress was held in the United States, at Chicago, in conjunction with the World's Fair of 1893 (21st to 25th August). At this congress the ohm, ampere, volt, coulomb and farad were confirmed and defined concretely under the title of "international" units to distinguish them from the "legal" or "B. A." values of preceding congress definitions. The henry was also adopted. The fifth International Electrical Congress was held at Paris in conjunction with the Exposition Universelle of 1900 18th to 25th August). It adopted the maxwell and gauss as titles for two C. G. S. magnetic units.

In addition to the official international work accomplished by these congresses in the establishment of units and standards, a very large amount of valuable work has been accomplished by them in the meetings of their sections. At Chicago thirty-three papers were read, twelve of which were presented by authors from abroad. There was also an important topical discussion. Owing to an imperfect preliminary organization, no funds were secured in advance for publishing these transactions. The transactions would have sunk into oblivion if the American Institute of Electrical Engineers had not assumed the tasks of printing and financing the publication. The transactions were published in 1894 in a handsome volume of 489 pages. The proceedings of the Paris Congress of 1900 have been published in two volumes, the first of 526 pages, which appeared in 1901, and the second of 318 pages, which has very recently been issued from the press. There were 920 members of this congress, of whom 469, or just about one-half, were French, while only about 42 were from the United States. The remainder, 409, were from various other parts of the world.

The transactions of an International Electrical Congress represent the permanent record of its achievement, and also represent the principal—almost sole—expense incurred in its work. It is highly desirable for the prestige of electrical America, that the International Electrical Congress to be convened at St. Louis next year, should be successful not only in its conventions and proceedings, but also in its records and published transactions. Ample accommodation has been promised by the St. Louis Universal Exposition for the congress and its sections, during the week September 12-17. We

understand, moreover, that the section officers are being, or have been, appointed. The list will no doubt be published as soon as it is complete. Not only the American Institute of Electrical Engineers, but also various other national associations connected with electrical applications, have signified their intention to assist in the development of the congress. Invitations are now being issued to all who are interested in electrical progress, requesting their membership. The membership fee not only will entitle the member to attend any or all of the meetings of the congress, but will also secure a copy of the transactions which are to be subsequently published. We understand that the invitations to join the congress will be issued first to all members of national electrical organizations in this country and abroad, and second to libraries and societies who may naturally desire to secure the transactions without necessarily taking direct interest in the sessions.

It is stated that the committee of organization of the congress is about to send invitations to a number of prominent electrical workers in this country and abroad requesting the favor of specially-prepared papers to be presented in the section meetings at St. Louis, as the basis of discussion and subsequent publication; also that the State Department will be requested to invite the home and foreign governments to appoint official delegates to the congress. It is expected that at least ten thousand invitations to join the congress will be issued, about half of which will be to individuals and associations in the United States. If a prompt and adequate support is returned, there is every reason to expect that the impetus which past congresses have given to electricity and its applications will be successfully followed by the convention at St. Louis. It is fitting that the first International Electrical Congress held in America at the World's Fair of 1893 should have a worthy successor in connection with the St. Louis Exposition of 1904. It would be a great pity if the good example left by Paris in 1900 could not be followed successfully on this side of the Atlantic, and its influence further extended as an incentive to yet more fruitful results.

Expert Testimony.

An interesting and somewhat amusing paper was that read before the recent Saratoga convention by Michael Brennan, Esq., dealing with some of the abuses conspicuous in actions of tort against corporations. His strictures are mainly against "damage lawyers" and incidentally against the expert testimony they invoke. There is no doubt that the damage lawyer and his expert are sometimes responsible for scandalous proceedings, but Mr. Brennan's suggested remedy is so naive as to be positively delicious. He suggests the revival of the old English statutes against maintenance and champerty, these being forms of malicious venal support of a suit brought by another, in which class Mr. Brennan would include the prosecution of damage suits on a contingent fee. It is obvious that such a step would simply license wealthy persons and corporations to accidentally maim or kill any member of the community too poor to employ eminent counsel, who as a class are seldom distinguished by a desire to work for nominal fees. Incidentally the knife would turn the other way and eviscerate the casualty companies, whose chosen business it is to defend, for a suitable stipend, suits against those insuring with them. It seems to us that there is a far easier remedy in the inculcation and enforcement of a sterner code of morals in the legal profession. A lawyer who seeks out damage cases to prosecute on shares with the help of perjured evidence certainly deserves disbarment if the offense can be proved. If it cannot be proved then it seems to us that Mr. Brennan is making rash accusations against his fellow members of the bar. With so potent a remedy as disbarment at hand, to say nothing of the statutes against perjury, it would seem that examples might well be made of a few offenders if the offense is as frequent as intimated.

The trouble is that counsel for the defense in such cases is very prone to assume that all cases are fraudulent and all damnatory expert evidence is perjured. We have, first and last, heard a good many tort and other cases involving expert testimony and have never yet been able to discern any difference in quality between the expert evidence for the plaintiff and that for the defendant, or between the moral codes of the respective counsel. The trouble lies very largely with the modes of procedure and the rules of evidence now in vogue. The latter seem specially suited to keeping the actual facts in the case from reaching the ears of the jury, and the former are admirably designed to encourage shady operations. There are doubtless expert witnesses to be found ready to support almost any fairly plausible contention, but as a matter of fact deception is often adroitly fostered by counsel in framing the questions. Under present practice the expert witness in a court case does not have the concrete case laid before him for his opinion, but is compelled to answer a hypothetical question involving just so much of the case at issue as counsel chooses. He is sworn to answer such a question truthfully, and so far as our observation goes, generally does so. His answer may or may not accord with the real facts in the case at issue, but this point he is not allowed to raise, being rigorously confined to the form of question asked. In cross examination he has to reply to still other hypothetical questions, skillfully framed to squint in the other direction, and often almost impossible to answer truthfully without conveying an impression almost wholly false to the casual listener. The result is that the experts for both sides, who on a joint investigation of the facts would probably agree very closely, are often compelled to support positions which seem to be diametrically opposite to the jury. Sometimes, of course, there may be honest differences of opinion, but many, perhaps most, of the apparent differences are due to adroit shading of the hypothetical questions for which the witness is in no wise responsible.

We heartily agree with Mr. Brennan that expert procedure ought to be radically changed, but in just what way is a question difficult to answer. We have sometimes thought that some relief might be obtained by removing the examination of experts from the hands of counsel entirely and placing it directly in the hands of the court. Even better seems the French procedure referred to by Mr. Brennan, in which the court, when technical questions arise, may direct their reference to a commission of experts acting in a quasi-judicial function under direction of the court as regards the issues to be considered. This method of action would certainly get at the facts and would give a weight and dignity to the opinions which they now generally lack. The present status of expert evidence is in every way unsatisfactory, both to the legal profession and to the experts themselves. In electrical cases, with which our especial interest lies, the abstruse nature of many of the considerations which arise renders expert testimony given in the usual way particularly unsatisfactory. Even in patent causes in which the procedure is far more direct than anywhere else, the expert testimony is generally needlessly elaborate and tedious, particularly in the cross examinations, which are usually wearisome and fruitless. A commission appointed by the court would be likely to lead to far more valuable results; and, lacking this, if the experts were merely directed to prepare technical briefs for submission with those of counsel, the court would be in a far better position than at present. Now the unfortunate justice has to wade through a technical slough of indefinite extent or trust to the more or less garbled extracts that find their way into the briefs. We hope that better days are at hand, but it seems difficult to get a reform started.

The Steam, Gas and Fuels Building at the St. Louis Exposition

Over a year ago Mr. Moore, chief of the machinery department of the Universal Exposition of 1904, claimed that the steam boiler, boiler appliance, gas producer and fuel handling exhibits would be adequately and creditably housed in a spacious building and that this building would be found in the center of the grounds and at the intersection of the main thoroughfares connecting the northern and southern and the eastern and western sections of the Exposition. To the outsider there seemed very little basis for this claim, but the physical evolution of the Exposition appears to substantiate Mr. Moore's prediction. What at first was a boiler house about 100 x 75 is now the Steam, Gas and Fuels Building, a steel construction, fireproof structure 326 x 300 ft. This building is over 60 per cent. completed and the installation of boilers in it is already progressing. The structure is particularly light and airy and all the arrangements are to contribute to the programme for making this building attractive not only to the engineering fraternity, but to the general public. It certainly is located at a point where, by the prominence of its location and the character of its surroundings, it can easily attract a full audience for its exhibitors.

The exhibits to be installed are intended to illustrate the most modern methods and economies in steam and gas generation and the handling and treatment of fuels. The illustration commences with the coal in 50-ton, hopper-bottom, self-cleaning steel cars controlled and operated by the Exposition. These cars bring the coal from the mine to the Steam, Gas and Fuels Building, where it is dumped and automatically conveyed to and from bunker and crusher, or either, and thence to the mechanical stokers, gas producers and briquetting machines. Over 2,200 lineal feet of conveyor lines are required in this automatic coal handling system. Bituminous coal, anthracite coal, briquettes and crude oil will all be availed of with the purpose of providing lines for comparison and to illustrate as fully as practicable the broad subject of the use of fuels for power purposes.

In both hand-firing and mechanical stokers, particular attention is being paid to the avoidance of the smoke nuisance. The stoker builders are afforded an opportunity to substantiate their claims in this direction, for on installations of 1,500 hp or over a separate stack is to be furnished by the Exposition for each installation and thus a line for practical demonstration and comparison is established. In hand firing, briquettes will be largely availed of and the claim of the possibility of smokeless combustion from their use can be substantiated or refuted.

Boilers have been drawn from Europe as well as from American shops, and particular attention is being paid to marine water tube boilers. The standard marine types of boilers are less familiar than the standard stationary types to the average engineer, and it is believed that where economy of space is an essential, they may demonstrate advantages. In any event, opportunity for direct comparison between the various water tube marine type boilers operating side by side and under the same conditions will be interesting and instructive. Different groups of boilers are to be operated at different pressures and practice, from 125 pounds to 250 pounds illustrated.

Owing to the central location of the Steam, Gas and Fuels Building and in deference to the architectural harmony, it is impractical to establish natural draft boiler stacks, and consequently mechanical draft will be availed of. This affords the blower builders an opportunity to exploit their systems.

The water supply in St. Louis is not without features which are objectionable in boiler practice, and this condition is very generally being availed of by the builders of water purifying apparatus to exploit the practical value of their systems.

The installation of a number of independent steam generating systems carries with it the possibility to illustrate a variety of accessory items, such as feed water pumps, feed water heaters, injectors, traps, valves, gauges and various steam specialties.

In gas producers the range is from a capacity to supply an engine of 50 hp to a capacity for a 3,000 hp unit or collection. The most notable producer units are as follows: One of 2,400 hp, direct-suction system, from Julius Pintsch, of Berlin; one of 3,000 hp, Duff-Whitfield system, from W. F. Mason & Co., of Manchester, England, and one of 2,000 hp, from R. D. Wood & Co., Philadelphia. Both of the latter will avail of tanks or holders. A Thiessen gas scrubber built by the John Cockerill Society, of Seraing, Belgium, will be shown in operation. The installations of the latest gas producers serving the latest types of gas engines driving alternators and operating side by side on the same load with steam boilers at the one end and steam reciprocating and turbine engines on the other end, will go far toward a determination of the claim by the gas engine advocates that the gas producer gas engine proposition has in efficiency and first cost and operating expense great and universal advantages over the steam boiler steam engine system.

The programme announced, and already so far carried into effect, that we may reasonably look for its complete fulfilment, certainly demands consideration and no small amount of admiration. If Mr. Moore succeeds in doing what he has planned he will deserve great thanks from the engineering world and in any event every assistance and encouragement should now be extended to him.

Figures of Electric Street Traction in New York City.

The Interurban Street Railway Company, of New York City, the greatest system in the world of electric street railway traction, has just issued its first annual report since taking over the Metropolitan, Third Avenue and allied properties. The Interurban Company now controls all the surface street railroad lines in Manhattan and Bronx, excepting one unimportant line. During the year 14.18 miles in Manhattan have been electrically equipped and 31 miles are under construction in the Bronx, thus adding 45 miles to the electric system. The system now covers 478 miles of roadway. In the past three years the Union Railway has constructed 53 miles in the Bronx and reconstructed 25 miles of old lines. By the close of the present fiscal year all the current required for operation of the system will be supplied from the company's two power stations, thus saving considerable cost.

The transfer system has been extended between Metropolitan and Third Avenue lines. Of the total of 622,071,723 passengers carried last year, 433,608,524 paid cash fares, while 188,463,199 used transfers.

The track mileage shows as follows:

	Electric.	Horse.	Total.
Metropolitan	133	91	224
Third Avenue	228	26	254
Total	361	117	478

Passengers carried were:

	Fare.	Transfer.	Total.
Metropolitan	323,491,446	145,691,999	469,183,445
Third Avenue	110,117,078	42,771,200	152,888,278
Total	433,608,524	188,463,199	622,071,723

The consolidated balance sheet showed total assets of $182,150,753, and the liabilities account showed a profit and loss surplus of $4,123,503. The capital stock is given as $67,582,100 and funded debt as $88,097,000. Other liabilities are real estate mortgage, $950,000; Interurban 10-year notes, $3,465,000, and Metropolitan Securities Company, $12,132,500.

Gross earnings increased $618,377 during the year. Subway construction and inconveniences arising therefrom prevented the increase from being larger, as also did the work of changing motive power. Operating expenses were increased by abnormally high prices for coal and advanced wages. Fixed charges were increased by interest on $11,000,000 Metropolitan Street Railway bonds issued.

No provision is made in the income account for the franchise tax.

In view of the uptorn condition of New York streets in every direction, entailing serious expense and loss of traffic, the showing is remarkably good and encouraging as to the future.

The consolidated income accounts show the earnings of the entire system as follows:

Gross	$21,549,545
Operating expenses	11,389,109
Net	$10,160,436
Other income	573,408
Total income	$10,733,844
Charges and taxes	7,366,189
Surplus	$3,367,655
Dividend on Metropolitan Street Railway stock	3,639,791
Deficit after dividend	$272,136

The Electric Light and Power Situation in St. Louis.

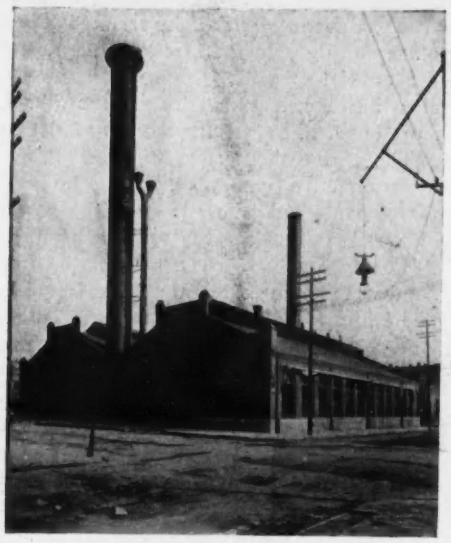


FIG. 1.—EXTERIOR VIEW STATION A MISSOURI-EDISON ELECTRIC COMPANY.

ST. LOUIS is attracting widespread attention at the present time as the place of the next World's Fair, the Louisiana Purchase Exposition. Many of those who will be drawn thither to learn of the progress made in the arts and sciences will be impressed with the increasing importance of St. Louis as an industrial center. Situated as it is, in the Mississippi Valley, at the center of a great railway system, it may be truly termed the "Gateway of the West." Considering the time of its incorporation as an American city as its birthday, St. Louis is the youngest of the four great cities of the United States; but its percentage of commercial growth during the past ten years was greater than that of any of the others. It is not only the fourth city in point of population, but the fourth in point of manufactures as well. It is one of the great railroad and commercial centers of the country, and in fact is a distributing center for the West, and the great Southwest in particular, which section is so rapidly being developed. The last United States census credits St. Louis with a population of 575,238, whereas the last local count shows that the 700,000 mark has been passed. The city covers an area of over 60 square miles, and has a frontage on the Mississippi River of nearly 20 miles.

The bank clearings of a city indicate perhaps more forcibly than any other statistics the condition of trade. During the past year the clearings of the St. Louis banks and trust companies amounted to $2,506,804,320, an increase of over 10 per cent. over 1901, while the combined capital and surplus of the 30 banks and trust companies is $87,267,173, with deposits amounting to $209,522,208.

St. Louis, although foremost in several lines of trade, is essentially the home of many and varied industries. There are approximately 7,200 different manufacturers in the city and its immediate neighborhood, employing 115,000 persons, paying $62,000,000 annually in wages, ,and producing a product of an estimated value of $390,000,000 annually. St. Louis holds first place as a jobber of shoes, of which it manufactured in 1902 1,151,000 cases. It is the largest drug market in the country, and the largest distributor in the West of dry goods and kindred lines. It is one of the largest mule markets in the United States, perhaps in the world. The city is also noted for a very large wholesale business in groceries, implements and woodenware, and the manufacture of plug and package tobacco and of beer. The coming World's Fair is a monument to the energy and the progressiveness of its citizens, and indicative of the resources of St. Louis.

In the past St. Louis has appealed to the investor and the central station manager as a most promising and profitable field for the exploitation of the electric light and power business. Recent events will serve, no doubt, to instill still greater confidence in existing and proposed investments, and in the possibilities of the business under the new conditions. In fact, it has been said that the possibilities of the central station business have been recognized by but few. Although the electric light on a commercial scale has been before the public for more than a decade, the greater part of the business secured so far has virtually been thrust upon the companies, and is not the result of a systematic, aggressive campaign. Investments have been made to take care of a natural increase rather than to develop the business to its fullest possible extent.

In recent years several large water powers at some distance from industrial centers have been developed, with what success is too well known to the public in general, to need extended comment. These in cases have been promoted without any legitimate business reason. It is true that some industries which were not dependent upon local markets, have been attracted by the comparatively cheap rates charged for power, but as is well known even at Niagara

FIG. 2.—ENGINE ROOM IMPERIAL ELECTRIC LIGHT & POWER COMPANY.

Falls, several years were required to dispose of the total output of the plant. The fact seems to have been overlooked that our great industrial centers offer a field for the electric light and power business which cannot be excelled elsewhere. The large and the small manufacturer in the many branches of industry, the merchant, the tradesman, offer opportunities for immediate and extensive development. It is not necessary to offer special inducements for these to locate at any particular point where they can be served. It requires but a catering to their wants at a cost which will not prove excessive, to secure an amount of business which will give profitable returns on a large investment.

The ancient history, so to speak, of the electric light business in St. Louis, is no doubt a repetition of that in other large cities in the

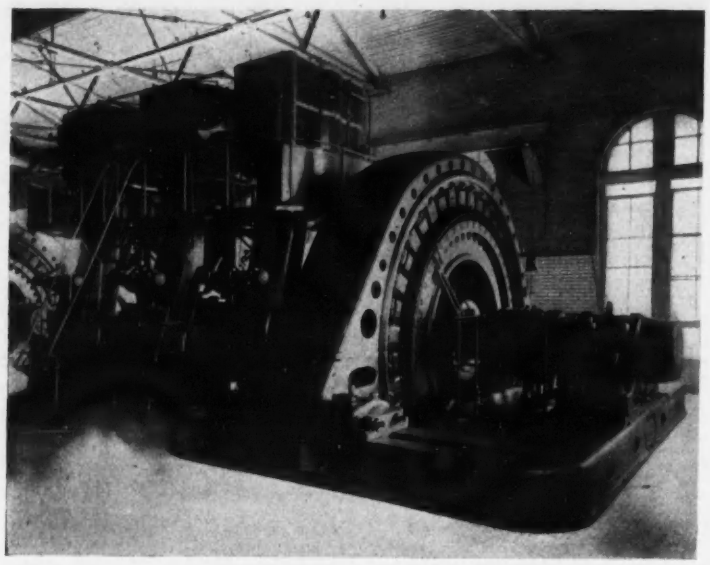


FIG. 3.—ENGINE ROOM STATION A MISSOURI-EDISON ELECTRIC COMPANY.

country. Several small plants were at first installed, representing the various systems then in use. In the course of time the "survival of the fittest" was inevitable. By consolidation, there remained two or three companies in the field to compete for the business. Even these were eventually united. This course possibly may be construed as having worked to the disadvantage of the public at large. In fact, it has been the commonly accepted opinion that competition is the life of business. To the student of everyday problems, however, the fact has been brought home more and more that such is not true in case of quasi-public corporations. Although some of the public may have been benefited temporarily, nevertheless it is the public at large and the public only which eventually must foot the bills for costly experiments in the duplication of physical plants and in ruinous competition.

The determination of the city of St. Louis in 1896 to force underground all overhead wires in the business district of the city, a course which in itself was commendable, resulted in the passing of an ordinance by the municipal assembly, by virtue of which it was possible for new interests to build underground systems in the down-town district and secure franchises for the operation of plants in connection with the former. Previous to that time the field had practically been covered by the Missouri-Edison Electric Company. A formidable competitor which now entered the field was the Imperial Electric Light & Power Company. The Citizens' Electric Light & Power Company at that time contented itself with the installation of an underground system, which course was also pursued by several subway construction companies. A further complication was introduced by the Laclede Gas Light Company, which in 1890 embarked in the electric light business, having secured a ten-year contract for the lighting of alleys, public parks and buildings north of Washington Avenue. Two other small companies had also engaged in the business, confining themselves either to a limited territory or a particular branch of the business. It will thus be seen that a condition of affairs existed which naturally led to evil results. Competition of a demoralizing character unavoidably resulted, which moreover did not necessarily benefit the consumer entitled to a reduction. Duplication of physical property was unavoidable. Operating and executive expenses necessarily were higher for the combined output than would otherwise have been the case with one operating company. Extensions were not made to the greatest advantage. The loss in income caused by the reduction in rates in certain districts was naturally made up by a corresponding increase in other sections. On the whole, a condition of affairs resulted which prevented a development of the business to the best advantage, and retarded rather than aided a natural growth.

When these facts are taken into consideration, as well as others, it seems to have been a most opportune time for the consolidation of the various interests. The Citizens' Electric Light & Power Company was about to become an active competitor, having designed and commenced the erection of a modern power plant. The power plants of the Missouri Edison Electric Company and that of the Imperial Electric Light & Power Company were loaded down to the limit of their capacity, and were about to require extensive additions to their equipment. The first steps looking to a consolidation were taken when the Imperial Electric Light & Power Company, on May 20, 1902, united with the Citizens' Electric Light & Power Company, under the name of the Union Electric Light & Power Company. A controlling interest was also subsequently obtained in the Missouri Edison Electric Company. The consolidation of the two large lighting companies on the 11th of last month under the name of the Union Electric Light and Power Company, is, therefore, in reality a mere technicality, as both are dominated by the North American Company, of New York.

The consolidation of the various interests has resulted in the inauguration of a broad and liberal policy, which contemplates the division of economies resulting from such a course with the consumer, to the ultimate benefit of all concerned. In fact, the consumer is to profit at once by economies which will be realized later as the commercial departments of the various companies are merged into one, the physical property developed as one unit and the new power house put in operation which will make possible the production of electric current at a low figure. It is only as a broad view of the situation is taken that success is assured. A large

FIG. 4.—BOILER ROOM STATION A MISSOURI-EDISON ELECTRIC COMPANY.

market and low production costs are of little avail unless a liberal policy is pursued. It is with this in view that a uniform system of rates for the entire system is being considered, which, based on the experience gained at other large cities, it is proposed shall make a charge for service that will be equitable under all conditions. As is readily understood, the systems of rates which have been in force differed from each other, and furthermore were influenced to a great extent in many cases by competition. This resulted in the charging of a high rate for certain classes of business in some districts, which, although bringing up the gross receipts of the companies, was a check to growth, while on the other hand a large part of the business was taken at an unprofitable figure.

As soon as it is possible to do so, the various commercial departments will be merged into one. It is self-evident that such a course will materially reduce the executive and general office expenses for a given output. The consolidation of the physical properties, however, although under consideration, will require a greater length of time. This of necessity has to be accomplished with the system in

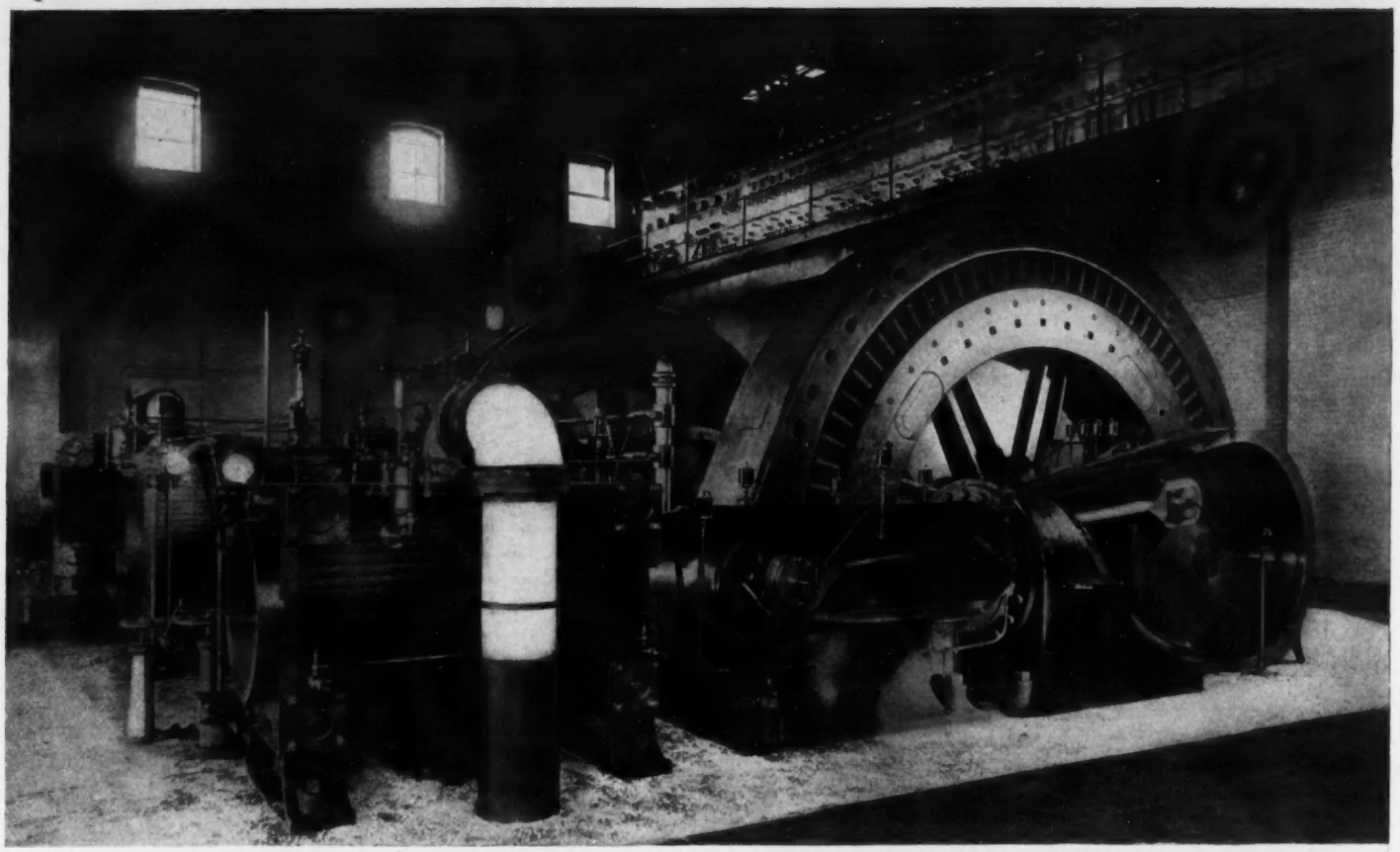


FIG. 5.—ENGINE ROOM STATION B MISSOURI-EDISON ELECTRIC COMPANY.

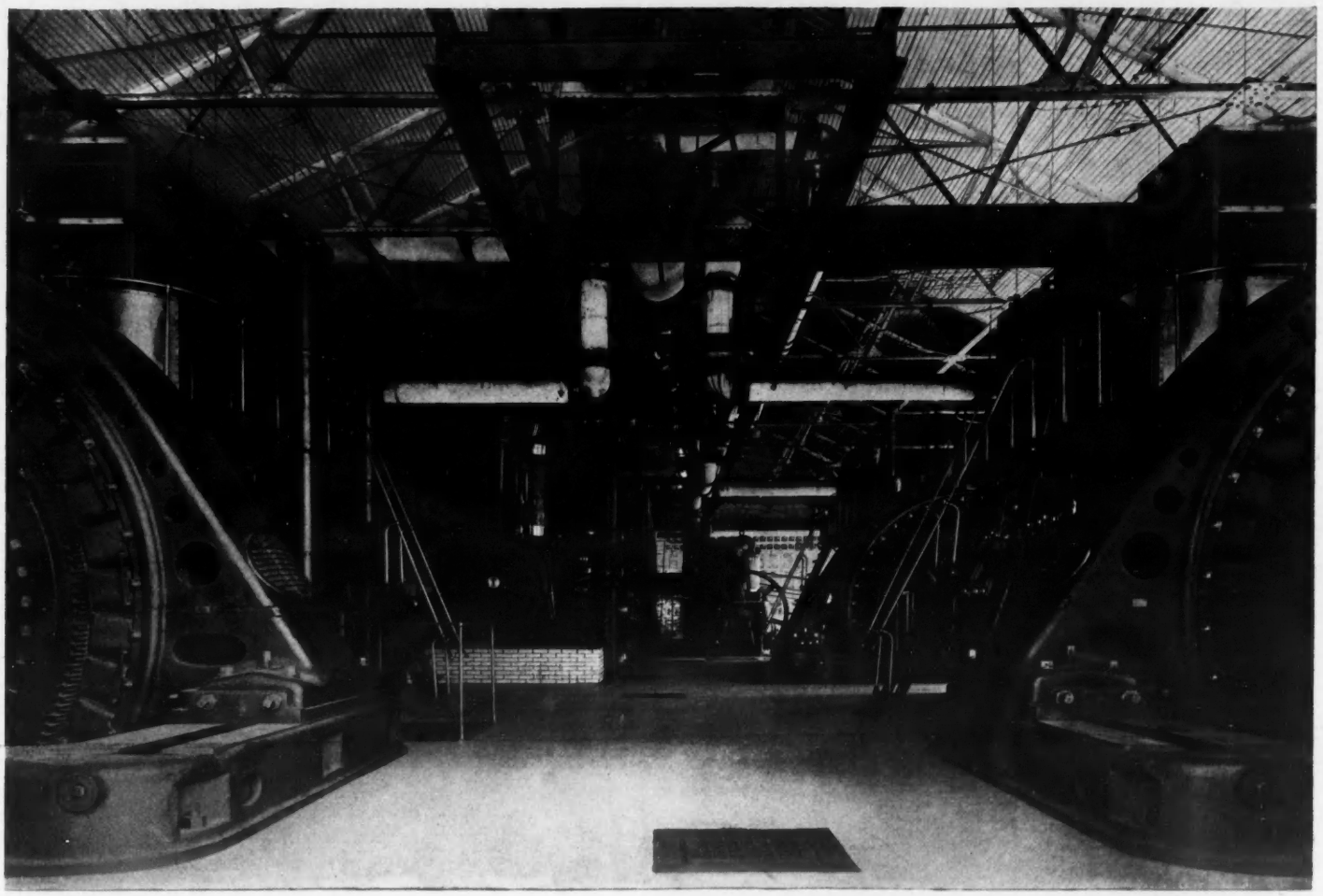


FIG. 6.—ENGINE ROOM STATION A MISSOURI-EDISON ELECTRIC

operation. At the present time the former Missouri Edison Company is operating a three-wire, 110 and 220-volt alternating-current system in the underground district, as well as 500-volt, direct-current circuits for power purposes. The same territory is also covered by the three-wire, 235 and 470-volt direct-current system of the former Imperial Electric Light & Power Company. To simplify the situation and prevent the duplication of lines, it will be necessary gradually to change over to an entirely new system, or to either one of the others already in use. It is possible that as soon as the new power house is in operation, temporary expedients may be devised to transfer the load to the latter. Arrangements have already been made whereby all of the 500-volt circuits in the underground district will be fed from the power house of the Imperial Electric Light & Power Co. at Tenth and St. Charles Sts., except at times of the lap load, when several units at Station B of the Missouri-Edison Electric Co. at Nineteenth and Gratiot Streets will be thrown in parallel with the load, as this station has an excess capacity of boilers. As the various plants will be fully loaded this fall, arrangements have been completed whereby in case of an accident, power will be obtained from the St. Louis Transit Company. Two 500-kw rotary converters through step-down transformers will convert three-phase currents at 25 cycles and 6,600 volts to 500-volt direct-current. The outlying districts are also to a great extent covered by lines of the Missouri Edison Co. and of the Imperial Electric Light & Power Company. The former are 1,000 volts alternating, while the latter are 500 volts direct-current. Several systems for

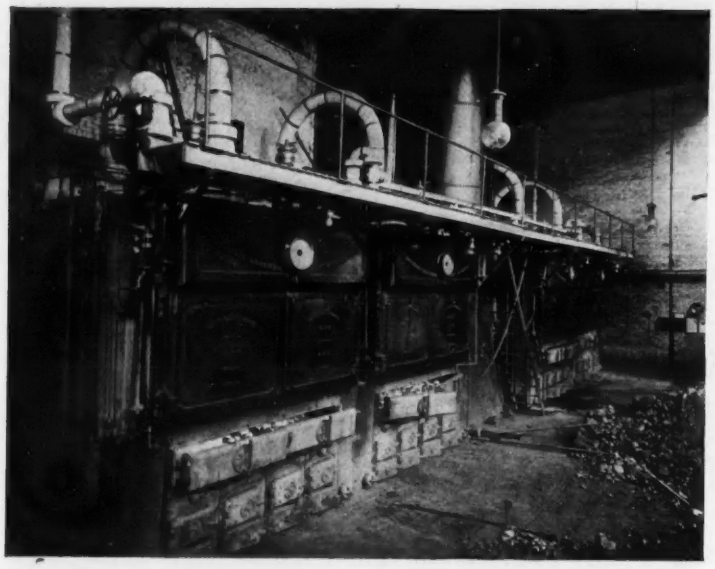


FIG. 7.—BOILER ROOM IMPERIAL ELECTRIC LIGHT & POWER COMPANY.

supplying this and other outlying territory with current from the new power house now building, are under consideration. Sub-stations will be located at various points, which will feed direct current at 235 and 470 volts into a network of overhead mains; or alternating-current feeders at 2,300 volts will be run, the secondary being a three-wire system operated at 110 and 220 volts, with banked transformers.

The power houses now operated not being very economical, the load on these will be transferred to the new one now building, as soon as it is possible to do so. In fact, the plants of the former Missouri Edison Electric Company are operated to a great extent, non-condensing, and that of the former Imperial Electric Light & Power Company has not sufficient capacity to operate the plant condensing under all loads. The apparatus in the former is not very modern, and does not permit of operation under favorable conditions. The rated capacity of the former Imperial Electric Light & Power Company's plant, at Tenth and St. Charles Streets, is 4,000 kw. The equipment consists of 500-volt direct-current generators, direct-connected to vertical cross-compound condensing engines. A 1,500-kw unit is operated by a horizontal cross-compound non-condensing engine. The plant includes a storage battery with a capacity of 1,000 amp. at the one-hour rate. The city arc lighting is done by twelve 110-light series direct-current arc light machines, driven by 500-volt motors. The boiler room equipment includes water tube boilers, which are hand-fired, and economizers.

Station A of the former Missouri-Edison Electric Co. at Nineteenth and Locust Streets is an alternating station which supplies the underground district in the business portion of the city. The normal capacity of this plant is 2,700 kw. The equipment consists of two-phase, 1,100-volt alternating-current generators, direct-connected to vertical compound engines. The nature of the apparatus in this as well as in Station B is such, however, that the generators cannot be run in parallel, and in consequence each one carries separate circuits. The boilers are of the water tube type and hand fired. Both of these stations, A and B, are the result of a gradual growth, and as a consequence, the arrangement and character of the apparatus is such as to prevent economical operation. Station B, which is situated at Nineteenth and Gratiot Streets, has a normal capacity of about 4,100 kw. The generators are single-phase, operated in part by simple and in part by cross-compound Corliss engines. The boiler room, which is located on the opposite side of the street from the engine room, contains water tube boilers which are hand-fired. The three plants which are now being operated, although not economical enough to warrant their continuance for any length of time in the future, nevertheless are in excellent condition to carry the lighting and power loads until such a time as it is possible to transfer these to the new power house now being erected.

At present there are in use nearly 160 miles of pole line, 95 miles of series arc circuits, 76 miles of feeders, 192 miles of two-wire mains and 60 miles of three-wire mains. In the underground district there are 37 miles of series arc light circuits, 10 miles of feeders and 22 miles of mains.

The new power house, as will be seen from the accompanying illustrations, is well under way, the construction being pushed as rapidly as possible. It is expected that part of the equipment will be in operation next April, and the remainder will be completed as soon as possible. It is estimated that the cost of the power house, including building and real estate, will be in the neighborhood of $2,000,000. Preliminary work of preparing the ground for the foundations was first commenced in February of last year. After two months, however, an injunction was secured by the city preventing any further work on the river front, as it was claimed that the power house would project beyond a line established by the city. The question was taken up with the United States Government, and after a vexatious delay the matter was settled in favor of the company, a new harbor line having been established which placed the building within the required limits. Further delay was occasioned by a very high stage of water of the Mississippi River, which continued during the entire season. This caused nearly a year's delay, although work proceeded on the engine room and the engine foundations.

The site is located near the center of the city, a short distance north of the Eads Bridge. It occupies an entire city block, and with a present length of building of 322 ft., allows for an extension of 100 ft., with additional space for storage. The building is of the steel skeleton type, supported by concrete walls resting on rock foundations, with terra cotta columns and brick curtain walls. Steel window and door frames are used, a fire-proof construction having been adopted throughout. The roof is lighted by five skylights, running crosswise of the building.

The power house equipment has been located and arranged with a view to securing the most economical operation of the plant. The current generated will be three-phase, 25 cycles, at 6,600 volts, and will be transmitted to the various sub-stations in the city for transformation. The current will not only be used for electric light and power purposes, but for the operation of the street railway system of the St. Louis Transit Company as well. At present the generators will be driven by reciprocating engines, although the use of the steam turbine for extensions is being considered.

The engine room is 322 ft. long and 81 ft. wide. The interior is finished with brown enameled brick to a height of 10 ft. from the main engine gallery, and above that height with white enameled brick. The only floors will be those at the sides of the foundation for the support of heavy parts which may be moved. Otherwise, all parts of the room will be reached by a series of galleries and stairways. The engine room consequently will be unobstructed from the basement floor to the roof, and will be served by a 50-ton traveling crane with a ten-ton auxiliary hoist. This will be operated by induction motors from the same circuits as the motors for the motor-driven exciter sets. All of the electrical equipment is of Westinghouse make.

The equipment at present will include two 1,500-kw alternators of

the revolving field type, each direct-connected to a vertical cross-compound Reynolds-Corliss engine made by the Allis-Chalmers Company. There are three further units of 3,000-kw capacity each. galleries located at one end of the engine room. This will provide for the control of two 1,500 and three 3,000-kw generators, four 125-volt, 100-kw exciters, and twelve feeders. Each generator will be

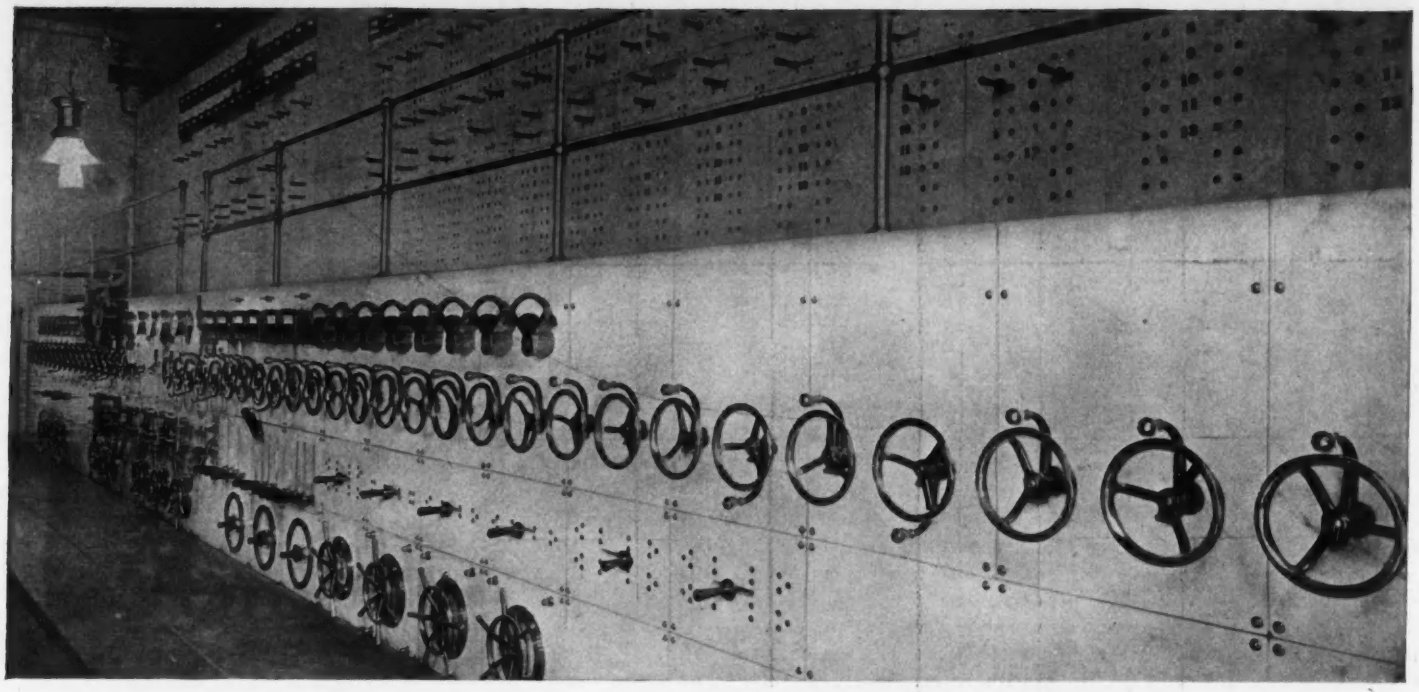


Fig. 8.—Switchboard Station A Missouri-Edison Electric Company.

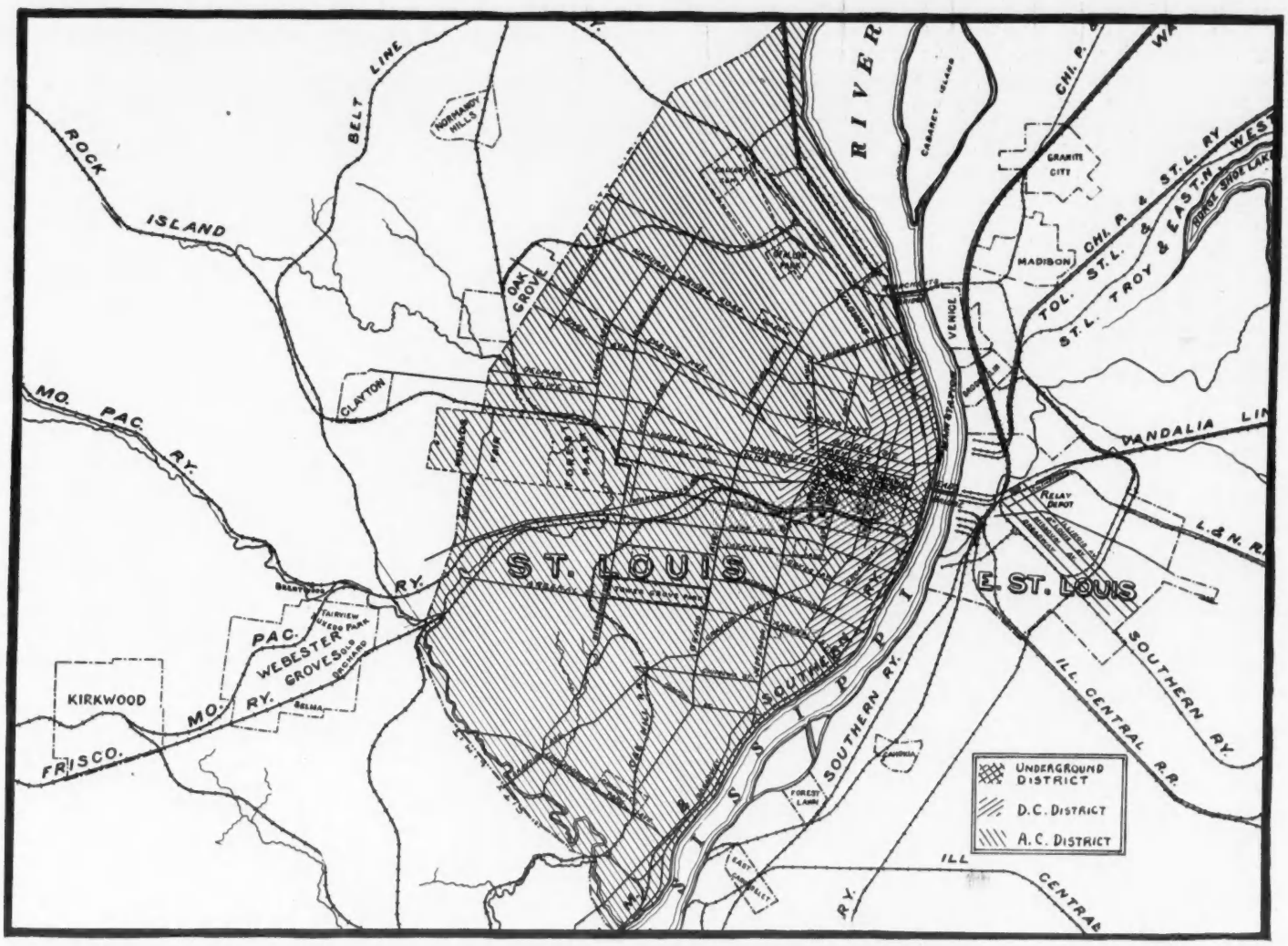


Fig. 9.—Map Showing Areas of Underground, Direct-Current and Alternating-Current Districts, St. Louis.

There will be three engine-driven exciters of a capacity of 100 kw at 125 volts each, and two motor-driven sets of the same capacity.

A switchboard of blue Vermont marble will be installed in several connected to a separate auxiliary bus. These auxiliary bus-bars will be connected through oil break switches and high-tension hook switches by duplicate sets of cables to a duplicate set of high-tension

bus-bars. The twelve feeders are connected to the former through interlocked selector switches.

The boiler room, although of the same length as the engine room, will be 94 ft. wide. The equipment will consist of 26 internally-fired boilers of the Scotch marine type, with the combustion chamber at the center of the boiler. These are 11 ft. 7 in. in diameter and 25 ft. in length. Two of the furnaces are 48 in. in diameter and one 52 in. Each will be equipped with a Jones underfeed stoker. Two brick stacks 200 ft. high and 14 ft. in diameter of Custodis construction, will be erected. Green's economizers will also be installed. The boilers will be placed in two rows, facing each other, and each pair will be connected with the steam header. Four boiler feed pumps of the Admiralty type will be used. The feed water heaters will be of the closed type, of special design. A Wheeler condenser will be installed for each unit, two of which will be placed between two engines, and so connected that either one can be used for either engine. The circulating water is pumped from the river by centrifugal pumps, which discharge into a large main leading to the condensers. From the latter the condensing water will overflow into the river. Both the circulating and the air pumps will be driven by steam engines.

On the east side of the boiler room, between two parallel walls, one of which will form the river wall, are located the coal bunkers and the settling tanks, which will be utilized for removing all suspended matter from the feed water, which is taken directly from the river. From these coal bunkers the coal will be taken into cars in the basement, which deliver the coal to the boot of a large elevator. This elevator places the coal in large tanks at either end of the building, under which passes the crane which delivers the coal to the spouts of the stokers. The same cars which handle the coal in the basement, also take the ashes from chutes underneath the boilers. The coal storage compartment delivers the coal into the cars at about the elevation of the boiler room floor. Above the coal storage, on top of steel girders which rest on the parallel walls already mentioned, is the track for the railroad cars. Either side or bottom dump cars will be available for unloading coal. Arrangements have also been made whereby coal can be unloaded from barges on the river. The coal storage space, which is of the same length as the engine and boiler rooms and about 20 ft. wide, will hold about 6,000 tons of coal. The ultimate storage capacity of the plant will be equivalent to about ten days' supply at the maximum rate of the plants.

In conclusion it may be said that the liberal policy inaugurated

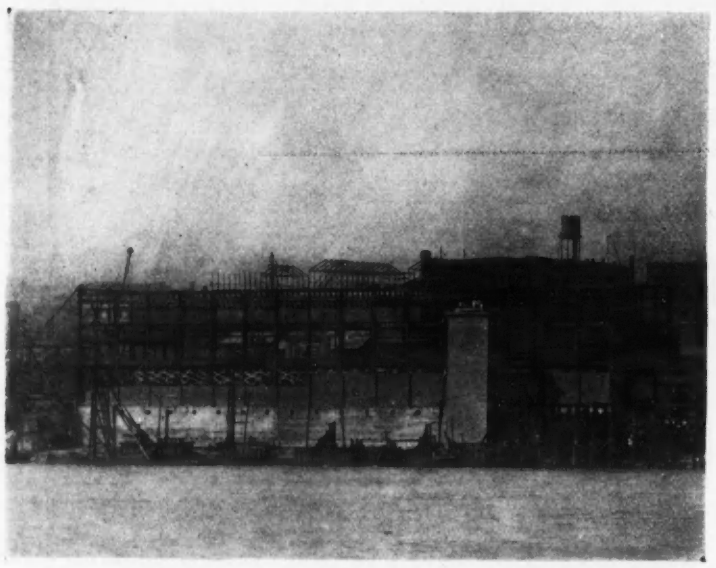


FIG. 10.—NEW POWER HOUSE UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS.

by the Union Electric Light and Power Company has already resulted in a considerable expansion of the business. It furthermore shows the possibilities which can be developed in such an industrial center as St. Louis when the conditions are thoroughly understood. What is without doubt the largest single contract in the history of the electric light and power business in the United States was secured from the St. Louis Transit Company. This calls for 9,000 kw 18 hours a day for a term of 10 years. The latter company had previously already closed contracts for the equipment of a new power house which was urgently required to supply the increasing demand of power for its system. Recognizing the value of such a consumer, negotiations were successfully brought to a close whereby the St. Louis Transit Company relinquishes the plan of building its own power house, and obtains all of its current from the Union Electric Light and Power Company. A further important contract is that with the Louisiana Purchase Exposition Company, which calls for a capacity of 6,000 kw during the period of the World's Fair. Further evidence of the liberal policy pursued can be adduced from the

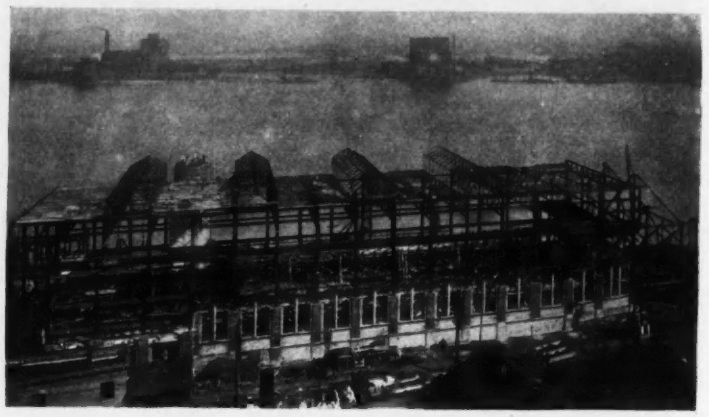


FIG. 11.—LOOKING ACROSS THE MISSISSIPPI RIVER FROM NEW POWER HOUSE.

number of isolated plants which have shut down since the consolidation. These are 22 in number, and ranged in capacity from 15 to 165 kw, with an aggregate capacity of 1,575 kw.

From the accompanying map it will be noticed that the greater part of the area of St. Louis is reached by one or the other of the company's lines. This possibly will produce the impression that the territory is already covered, but such is not the case, when the foregoing is considered. Although a large number of isolated plants have already been shut down, a large number are still in operation. Although within the last five years the gross receipts of the combined companies have increased 50 per cent., and the total during the past year was nearly $1,500,000, a consideration of the results obtained since the inauguration of the new policy will lead to the conclusion that the business secured in the past is but a small part of that which awaits development.

Twelfth Annual Convention of the Pennsylvania Street Railway Association.

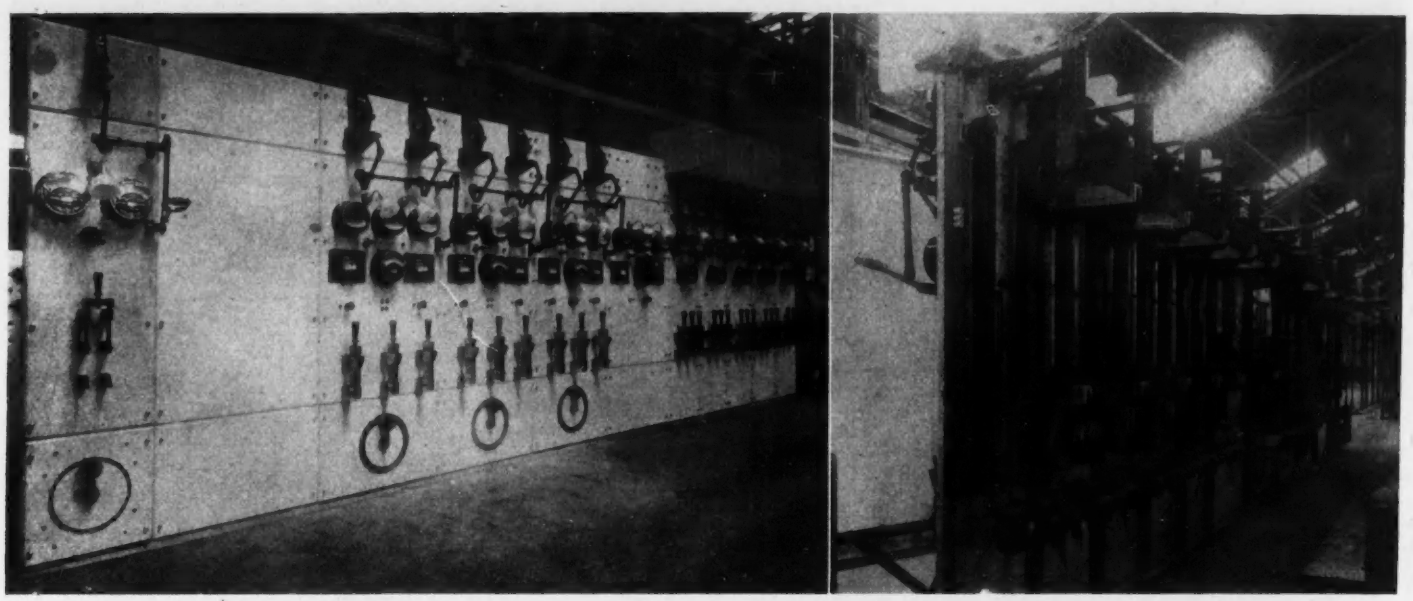
The Pennsylvania Street Railway Association held its twelfth annual convention in the ball room of the Park Hotel, Williamsport, Pa. The convention was called to order by President Ernest H. Davis, who, after responding to the Mayor's welcome, laid particular stress upon the question box idea, and expressed the hope that through the hearty co-operation of the members the feature would prove of valuable assistance to street railway men. In referring to the development of interurban railways, Mr. Davis said that their construction had been greatly hindered, owing to unnecessary restrictions in State laws, and he called upon the members to use their utmost influence to secure more favorable legislation for interurban railways.

The afternoon session was devoted to the reading of and discussion on John F. Ohmer's paper entitled "Fares and Fare Protection." In the evening the delegates enjoyed a smoker at the Park Hotel. The following day over seventy delegates took a pleasant trip, in three special coaches, to Eagles Mere, via the Reading, Williamsport & North Branch Railroad. The election of officers resulted as follows: President, F. B. Musser, general manager, superintendent and purchasing agent of the Harrisburg Traction Company; secretary, C. H. Smith (re-elected), superintendent and purchasing agent of the Lebanon Valley Street Railway Company; treasurer, William H. Lanius (re-elected), president of the York County Traction Company.

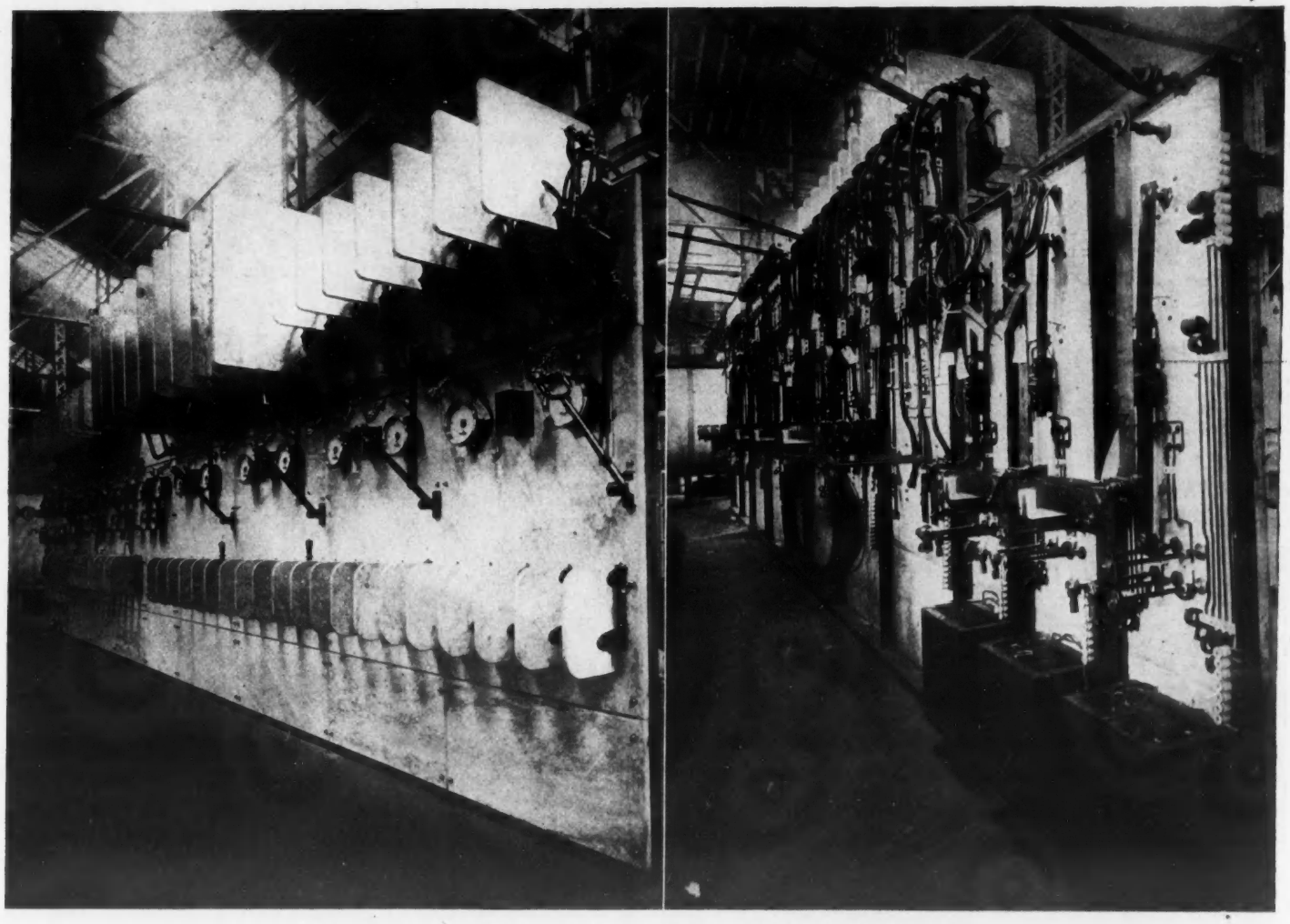
Alternating Current Switchboards--IV.

By Stephen Q. Hayes.

ANOTHER type of panel similar to that described in the preceding article is shown in Fig. 22, the main difference being that the circuit-breaker slab is made 25 in. higher to accommodate the necessary closing mechanism; the main slab is increased to 65 in. to hold the additional meters, and a few other changes are made. These boards are built for the same voltages as the other type, namely 100-600, 1,100-2,200 and 2,200-6,600, and the same general remarks relative to the types of switches, meters, circuit-breakers, etc., will hold good for both types. The illustration shows one of the boards built of this type—made, in fact, previous to the standardization of this line of panels—but it illustrates very well the general construction. The board shown differs from the present standard in the following particulars: The circuit-breaker panels are 18 in. high, instead of 25 in., making it necessary to locate the closing mechanism of the circuit-breaker off the instrument slab instead of on the upper slab; different types of ammeters and voltmeters were used, and two single-phase Niagara type indicating wattmeters, connected to properly divide the load on three-phase circuits employed, as the polyphase indicating wattmeters were



Figs. 22 and 23.—Front and Rear Views of 600-volt Switchboard.

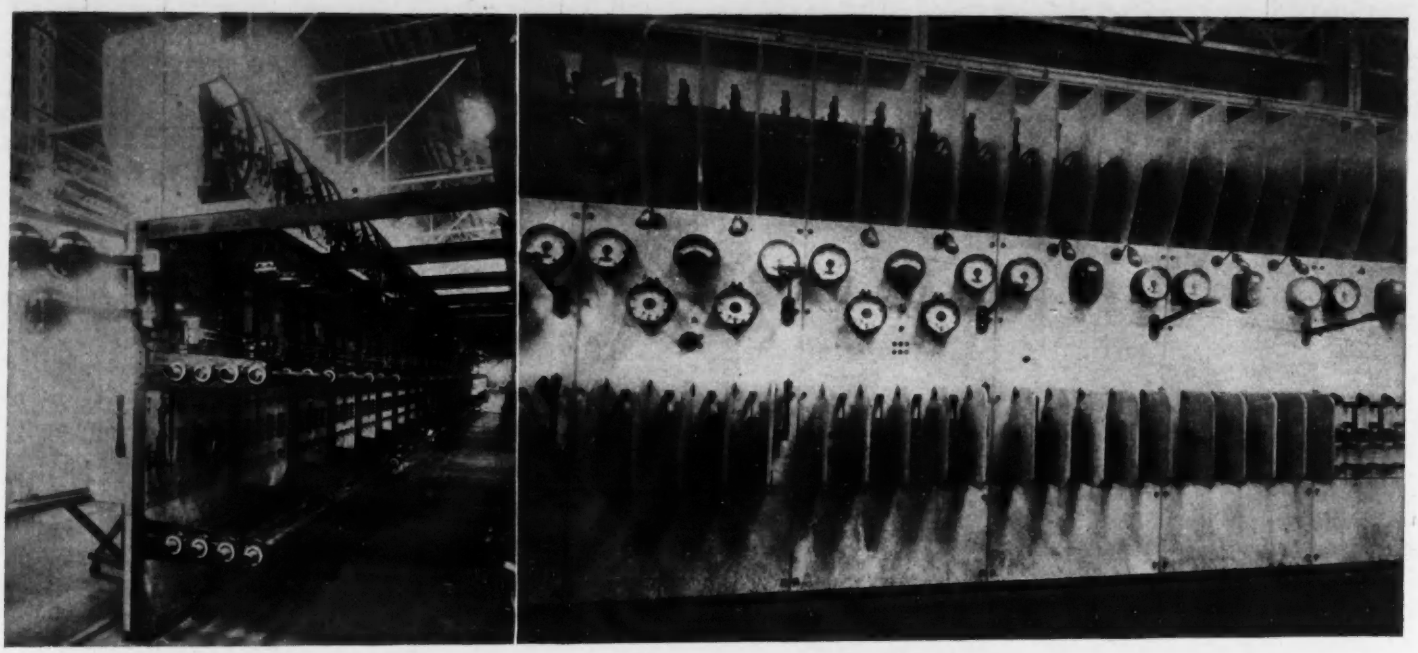


Figs. 24 and 25.—Front and Rear Views of 2200-volt Switchboard.

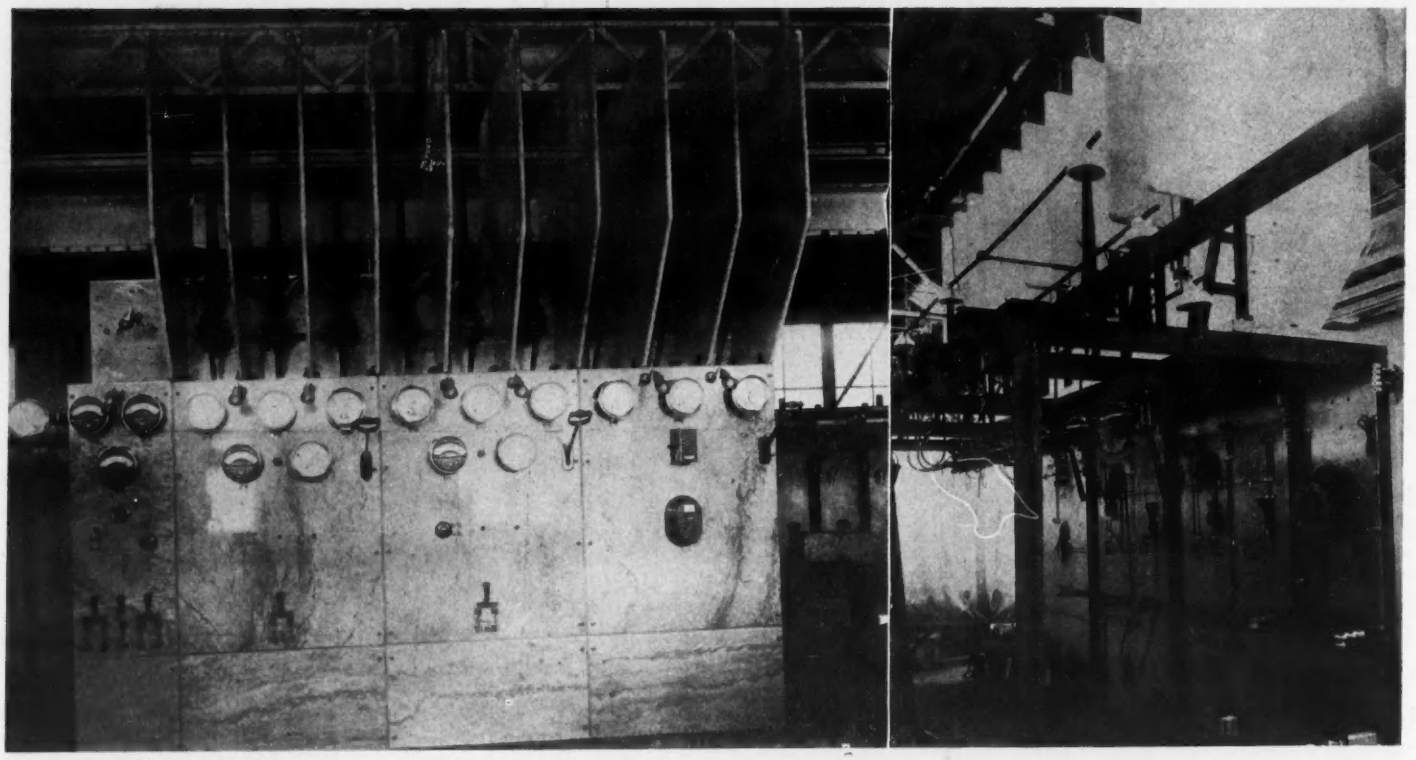
not designed when the board was built; field plugs were used instead of field switches, and the feeder panels were built 24 in. wide instead of 32 in., the present standard for this size.

Fig. 23 shows rear view of this same board and illustrates the bus-bar construction, the strap connections, series transformers, etc. These strap connections are made with copper straps 3 in. x ¼ in. in section, spaced ⅜ in. apart, a sufficient number being provided to carry the current without undue rise in temperature. With very heavy currents, such as are handled on these boards, the outer bars will carry more current than the inner ones, due to the so-called "skin effect." As this effect is more noticeable at higher frequencies, more straps are used for the same current at 60 cycles than at 25 cycles or for direct current.

feeder panels, which as a rule control banks of raising transformers feeding power transmission lines, are usually supplied with overload time-limit breakers. The function of the time-limit relay is to delay the opening of the circuit-breaker for some predetermined length of time, ranging from one to ten seconds after the overload or short-circuits come on the transmission line. This device prevents a temporary overload or short-circuit in one of the sub-stations fed from the transmission line cutting off the power from the entire line, as it gives time for the sub-station breakers to come out, simply cutting off the one station. The panels are also built for 1,100-2,200 and 2,200-6,600 volts similar to the corresponding panels of the type previously described, with the addition of a single-throw or double-throw square shaft switch connected



FIGS. 26 AND 27.—SIDE AND FRONT VIEWS OF 2200-VOLT SWITCHBOARD.



FIGS. 28 AND 29.—FRONT AND REAR VIEWS OF 11,000-VOLT SWITCHBOARD.

The 600-volt panels of this type are built for practically the same work as the type previously described, using the same type of meters, switches, breakers, etc., so that it is not necessary to repeat the remarks on these items. There are a few points of difference, however, that may be briefly noted.

The circuit-breakers, instead of closing singly, are thrown in all at the same time by the action of cross shaft and lever. The in series with and interlocked with the main circuit-breaker.

Fig. 24 shows a front view of a 2,200-volt, two-phase switchboard illustrating the type of switches and circuit-breakers used. Fig. 25 is a rear view of the same board and shows the bus-bars, series and shunt transformers, ground detector condensers, etc.

Another type of panel is illustrated in section in Fig. 26. In this board, which is for 2,200 volts, channel iron braces are run from

the top of the meter and switch panels to the wall and the circuit-breakers are supported on slabs resting on these horizontal channels and the various poles of the breaker are separated by marble barriers. The bus-bars on this particular board were 2-in. round copper rods insulated with fullerboard and mica tubes and later covered with asbestos steam pipe covering for the purpose of fire proofing.

Fig. 27 is a front view of this board and shows how the breakers are set back of the board and illustrates the type of switch used. These switches consist of knife blades mounted on an insulated shaft, and separated by marble barriers. These switches are not used to open the circuit under load and in fact are so interlocked that when the breaker is closed it is impossible to open the switch, but if already open can be closed. When the breaker is open, the switch can be opened or closed and thrown over from one bus to the other. The breakers used generally are the stick form, described in connection with a previously described type. The synchroscopes are here also mounted on swinging brackets. There is an ammeter for the field circuit on each generator panel and an ammeter is furnished for each phase. On two-phase generator panels there are two single-phase indicating wattmeters, and on three-phase generator panels a polyphase indicating wattmeter is used.

Panels of this type for 2,200-6,600 volts are similar to those just described except that they are only built for three-phase work, and the breakers and switches are designed for the higher voltage. The panels for 6,600-11,000 volts are also similar to those just described, except that there are no switches, the circuit being opened and closed on the breakers, which are of suitable size to successfully handle currents at this voltage.

Fig. 28 illustrates a board of this type used for the control of two 500-kw, 11,000-volt, three-phase generators, two 37½-kw, 125-volt exciters, and one main outgoing feeder. On the upper slab of the double exciter panel should be a pair of static ground detectors connected to condensers on the main high-tension bus-bars, but these instruments and the generator rheostats were not mounted when the switchboard was photographed. A polyphase integrating wattmeter is mounted on the feeder panel to measure the entire output of the station. Fig. 29 is a rear view of this same board and illustrates the bus-bar construction, location of series transformers, etc., and shows how the high-tension wiring is kept away from the instruments, etc., with which a person is liable to come in contact.

Sources of Rubber Supply.

The Department of Agriculture has issued an interesting bulletin on rubber culture and production in the Central American States and the dependencies. The publication is the work of O. F. Cook, botanist in charge of tropical agriculture, who has made an exhaustive study of rubber culture in every field of production. Its importance appears from the fact that rubber is the third of the large imports from the tropics, sugar and coffee being the first and second respectively. The average value of the yearly importance of rubber is $28,000,000. These studies are directed primarily to the question whether rubber culture is promising for Porto Rico and the Philippines, and the principal fact established in this report, namely, that a continuously humid climate is neither essential nor even desirable for rubber culture, promises well for the extension of this industry to the tropical islands of the United States.

It is now accepted that rubber can be cultivated and that the supply from wild growths cannot be relied on for a sufficient amount from year to year. At the same time it has hardly been shown that cultivation is safe and profitable, and the whole industry may be said to be still in the experimental stage. It has been demonstrated that the Para tree may be cultivated interchangeably with the Castilla in Central America and Porto Rico, and is producing handsome results in the Malay Peninsula, Ceylon and Borneo. The variety of soils, exposures, altitudes and climates where Castilla will be successful have been found to embrace widely separated sources of supply. Mr. Cook commends rubber culture in the Philippines in view of what has been learned about Castilla.

Studies of Castilla in Mexico have resulted in a favorable opinion regarding the prospects of Castilla in Porto Rico, since it is believed that the requirement of continuous heat and humidity has been overstated. Mr. Cook says there are toward the southwest corner of the island many places where the climatic conditions are not unsuited for Castilla and where experimental plantings should be made.

An Object Lesson in Telephone Receivers.—V.

By Arthur V. Abbott, C. E.

THE HOLTZER-CABOT RECEIVER.

THIS model is illustrated in Figs. 77 to 80, inclusive. Fig. 77 shows it assembled in readiness for use. In Fig. 78 it is dissected. The case consists of two parts, a body and a receiver cap. The magnetic system is built of U-shaped bars of steel which

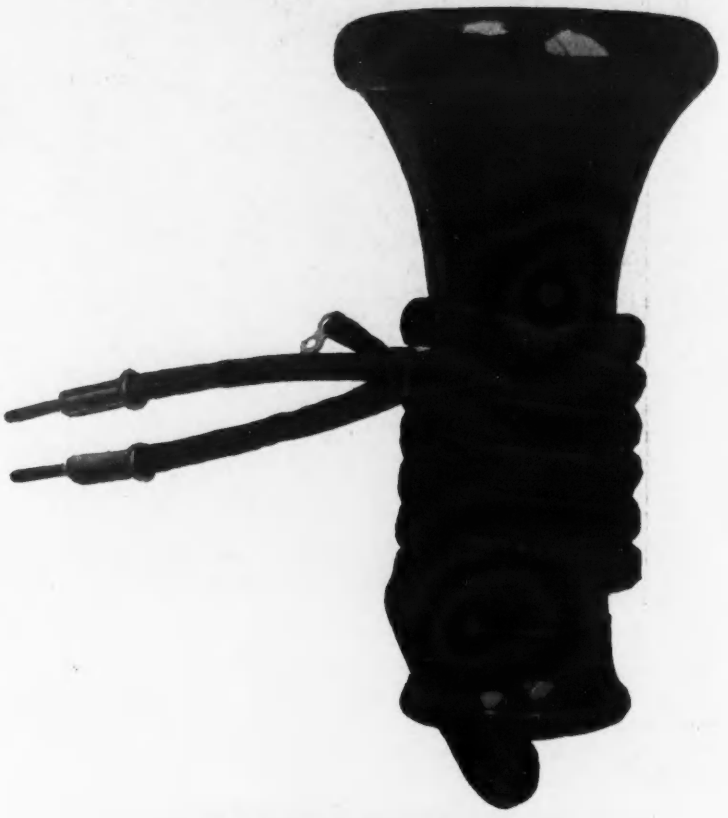


FIG. 77.—RECEIVER ASSEMBLED.

FIG. 78.—RECEIVER DISSECTED.

is slightly semi-circular in section. The bar is .624 in. wide and .26 in. thick and 3.5 in. long. The pole pieces are nearly semi-

circular in section, .47 in. wide, .15 in. thick, .47 in. wide and 1.25 in. long, and are secured to the magnet by a pin, which is driven through the magnet bars, the pole pieces and a filling piece. The coil spools fit the pole pieces and are .43 in. wide, .81 in. long and .36 in. deep. The winding is No. 36 wire and the resistance 70 to 80 ohms; the coils are connected in series. On the inside of the shell a bearing is faced. Between the magnet bars and the line spools a block two clips are placed. The cord terminals are attached to one end of the clip line, the leading-in wires to the other, and then they extend to the coil spools. Figs. 79 and 80 are the phantoms from this receiver, Fig. 79 showing the phantom with the diaphragm removed, and it is curious to note that this field is almost circular in cross-section, which would apparently correspond in distribution very closely to the shape of the diaphragm. Fig. 80 is the phantom

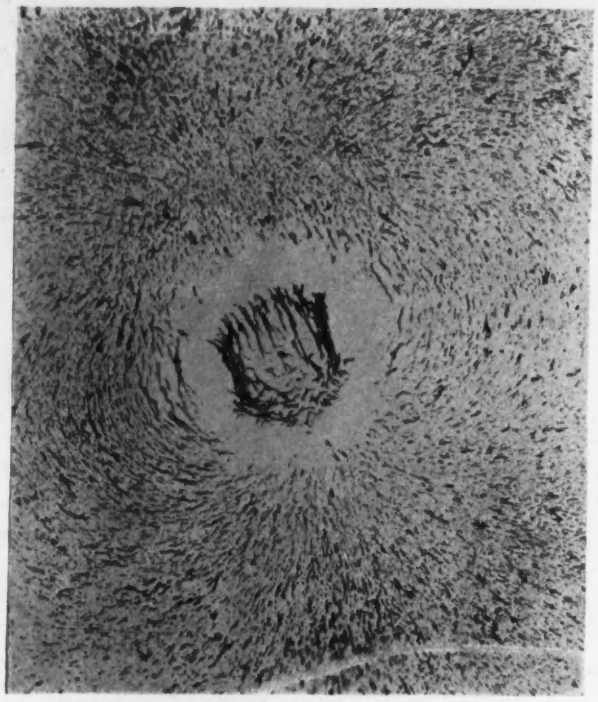


FIG. 79.—PHANTOM OF RECEIVER WITH DIAPHRAGM REMOVED.

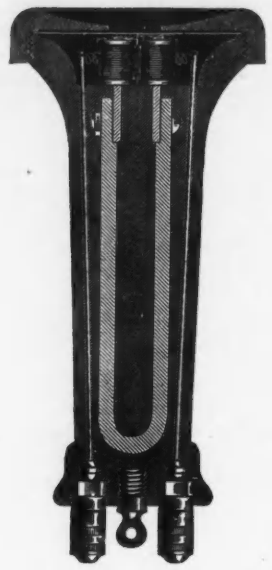


FIG. 81.—THE SOLID RECEIVER.

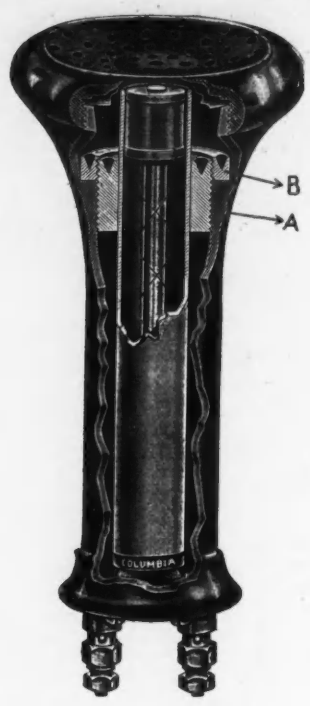


FIG. 82.—COLUMBIA RECEIVER.

non-metallic disc is set which is brought to a bearing upon the ledge on the inside of the shell, and the magnetic system held in place by four screws, which pass through this disc into the receiver case. The diaphragm is of sheet iron, tinned flat; .013 in. thick, 2.1 in in diameter and 1.87 in. free diameter. The face of the case is

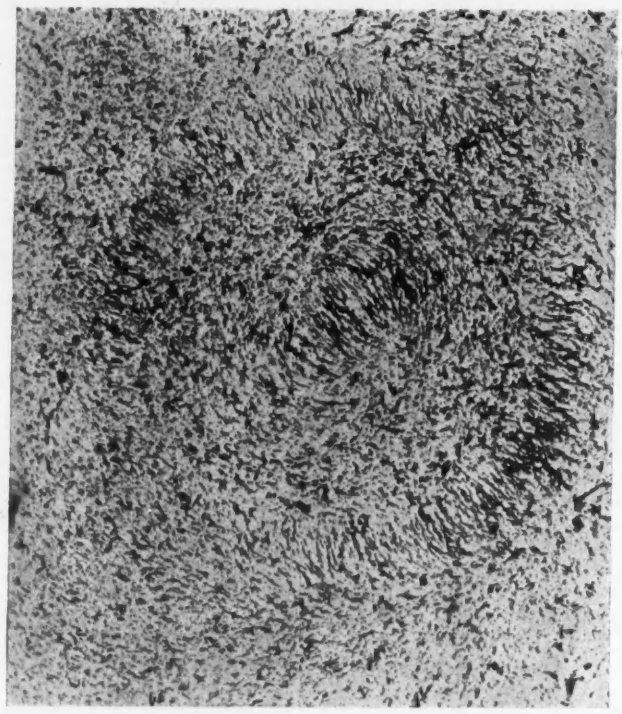


FIG. 80.—PHANTOM OF RECEIVER WITH DIAPHRAGM IN PLACE.

machined and the diaphragm clamped between the cap and the body of the case. The receiver cord passes through a hole in the rear of the case, the braid of the cord is then looped around the U of the magnet, and there tied so that the entire receiver hangs to the braid thus attached to the magnetic system. Between the faces of the magnet a fibre block is placed to which the cord terminals are carried and attached by means of two screws. Upon this fibre with the diaphragm in place, and indicates an exceedingly uniform distribution with a diaphragm that is not oversaturated.

Fig. 81 is rather a unique model of receiver and is only known as being an attempt to produce a design which could be subjected to any amount of abuse without injury. The magnetic system consists of a U bar upon the end of which the customary pole pieces are placed. Besides this U bar two leading-in wires are placed that are attached to two binding posts set near the end of the magnet. Thus the whole arrangement is placed in a mold and composition pressed around it so that the leading-in wires, magnetic system and pole pieces are cast into a solid block of composition. The case is then faced off, the coil spools pressed upon the pole pieces and the terminal wires soldered to the leading-in wires. The diaphragm is then placed on the case and the diaphragm cap secured home. Obviously there is no possibility of adjustment to this receiver after it is once manufactured, and in case of any injury to any part the easiest method of repair is to throw the receiver away and buy a new one.

FIG. 83.—THE SUN RECEIVER.

The Columbia receiver, shown in Fig. 82, is a design using a shell magnet instead of a bar magnet, as is shown in the illustration. The magnetic system consists of a central pole piece, upon the end

of which the line wire coil is placed. This bar is enclosed in an iron tube, which forms the other half of the magnet system. Around this tube a composition bushing is placed which is threaded to fit a corresponding screw thread in the interior of the case. The magnetic system is then screwed home and adjusted at the proper distance from the diaphragm. Then a lock nut is screwed on the outside of the bushing, which locks it against a ledge machined in the receiver case. The diaphragm is secured in the usual manner by clamping it to the face of the case by means of a diaphragm cap. The Columbia receiver adopts a method similar to that used in the receiver of the Western Telephone Construction Company, of perforating the diaphragm cap with a number of small holes instead of a large central aperture. This by some is considered an advantage, as it prevents the curious or malicious from poking the diaphragm with a pencil or other object, and thus bending it out of shape. Doubtless this is an advantage from a maintenance standpoint, and while it is asserted that this method of making the diaphragm cap does not perceptibly impede the delivery of sound waves to the air, it seems almost certain that the larger number of small holes must exercise some perceptible retarding action upon the air impulses.

The model which is known as the Sun receiver, exhibits a peculiarity in the adjustment of the pole pieces to the diaphragm. As is shown in Fig. 83, the model consists of a case, body and a diaphragm cap. The magnetic system is composed of two parallel bars that are united by two bolts and filling pieces, those at the rear being of

TABLE VI.—RECEIVER DATA.—THE MAGNETIC SYSTEM.

		Width ins.	Thickness ins.	Shape.	Dist. between base. ins.	Area sq. ins.	Length in.	Traction effort gram.	Remanence Gausses	No. of base.
1	A. B. T. Co. Hand Receiver	.730	.25		.50	.157	3.25	588	4250	2
2	" " " " Head " ..	.425	.127		...	.053	....	477	3500	2
3	Stromberg Carlson Hand " ..	625	.24		.32	.150	4.60	1332	5800	1
4	American Electric Telephone Co. " ..	655	.25		.32	.164	4.25	964	4750	1
5	Kellogg Switchboard & Supply Co. " ..	630	.24		.38	.151	3.50	1170	5400	2
6	Manhattan Hand - " ..	628	.120		.31	.075	3.75	364	4300	2
7	" Watch Case " ..	Steel	Cast'g		...	...	....	156	....	..
8	Erickson Telephone Co. - " ..	.622	.20		.50	.125	4.00	1177	6000	1
9	Western Telephone Construction Co. " ..	.627	.24		.38	.151	3.50	553	4000	1
10	Swedish American - " ..	623	.23		.25	.142	3.75	761	4500	1
11	Holtzer-Cabot	.624	.26		.38	.158	3.50	1262	5500	1

TABLE VII.—RECEIVER DATA. THE POLE PIECES.

No.	Name.	Width, in.	Thickness, in.	Length, in	Area, sq. cm.	Dial lt. center, in.	Magnetization of wire.
1	A. B. T. Company hand receiver	.540	.085	1.36	.30	.312	9600
2	A. B. T. Company head receiver	.375	.086	.50	2.05	.500	9700
3	Stromberg-Carlson hand receiver	.590	.100	1.18	.38	.436	13100
4	American Electric Telephone Company receiver	.610	.100	1.50	.39	.420	10900
5	Kellogg Switchboard & Supply Company receiver	.540	.102	1.25	.36	.420	12300
6	Manhattan hand receiver	.630	.120	Prolongation of in.	.52	.480	6000
7	Manhattan watch case receiver	Steel pin	.280" diam.	.145" hole	.26	...	5300
8	Erickson Telephone Company receiver	.573	.115	.970	.43	.415	11600
9	Western Telephone Construction Company receiver	.495	.090	.970	.29	.412	9680
10	Swedish American receiver	.625	.120	1.31	.45	.500	8800
11	Holtzer Cabot receiver	.470	.150	1.120	.46	.475	10500

TABLE VIII.—RECEIVER DATA. THE LINE COILS.

No.	Name.	Width, in.	Length, in.	Depth, in.	Material.	Wire. No. B. & S.	Resistance, ohms.
1	A. B. T. Company hand receiver	.40	.90	.43	Brass	36	20 to 26
2	A. B. T. Company head receiver	.37	.68	.31	Brass	38	60
3	Stromberg-Carlson hand receiver	.44	.86	.50	Fibre	38	94
4	American Electric Telephone Company receiver	.40	.90	.62	Brass	36	125
5	Kellogg Switchboard & Supply Company receiver	.41	.90	.42	Brass	30	69
6	Manhattan hand receiver	.44	1.00	.43	Brass	36	68
7	Manhattan watch case receiver	1 spool	Circular 1" diam	.312	Wood	38	73
8	Erickson Telephone Company receiver	.41	.88	.31	Brass	36	121
9	Western Telephone Construction Company receiver	.42	.83	.37	Brass	36	98
10	Swedish American receiver	.43	.92	.43	Brass	34	75
11	Holtzer Cabot receiver	.43	.81	.36	Brass	36	78

TABLE IX.—RECEIVER DATA. THE DIAPHRAGM.

No.	Name.	Thickness, in.	Diameter over all, in.	Full diameter, in.	Material.	Coating.	Shape.
1	A. B. T. Company hand receiver	.01	2.25	1.93	Ferrotype	Varnish	Flat
2	A. B. T. Company head receiver	.01	2.00	2.00	Ferrotype	Varnish	Flat
3	Stromberg-Carlson hand receiver	.01	2.19	2.12	Sheet iron	Tin	Flat
4	American Electric Telephone Company receiver	.01	2.12	1.87	Sheet iron	Tin	Dished
5	Kellogg Switchboard & Supply Company receiver	.011	2.18	1.93	Ferrotype	Varnish	Flat
6	Manhattan hand receiver	.01	2.25	1.75	Ferrotype	Varnish	Flat
7	Manhattan watch case receiver	.005	2.00	1.75	Ferrotype	Varnish	Flat
8	Erickson Telephone Company receiver	.01	2.31	2.00	Sheet iron	Tin	Flat
9	Western Telephone Construction Company receiver	.011	2.13	1.93	Sheet iron	Tin	Flat
10	Swedish American receiver	.014	2.19	2.00	Sheet iron	Tin	Flat
11	Holtzer Cabot receiver	.013	2.13	1.87	Sheet iron	Tin	Flat

magnetic and those in the front of non-magnetic material. The pole pieces are secured to the front bolt and carry the coil spools to which is bolted a heavy brass plate, on top of which the diaphragm is placed. The pole pieces extend through the brass plate, which is faced off and forms a bearing for the diaphragm. This brass plate bears against the body of the case, and the diaphragm cap clamps the diaphragm case and magnetic system together at a single operation. While this model is similar to those of the Swedish-American and the American; it is a departure in placing the supporting plate outside of the line coils, and thus reduces to a minimum all of the resonant cavities of the receiver. For the sake of easy comparison the data of the models illustrated is collected into the following four tables: No. 6, the magnetic system; No. 7, the pole pieces; No. 7, the line coils; No. 9, the diaphragm.

Electric Power for New England Mills.

In a paper read at the recent meeting of the New England Cotton Manufacturers' Association, Dr. F. A. C. Perrine discussed the economics of water power development and suggested a change from the present practice of each mill generating its own power to a system whereby power for all the mills in a given district would be generated and distributed from a central station plant.

New England mills are equipped with both steam and water power, and there is probably no body of men in the country more familiar with variable water power than their superintendents. Water powers not continuous require an equivalent steam power equipment of engines, boilers and men, with interest charges, and in consequence such powers only effect a saving equivalent to the fuel consumption of the steam engine. This, with continuous power and coal at the average New England price, amounts to approximately $36 per hp-year, and in consequence it is not reasonable to contemplate the development of excess power beyond the continuous flow of the stream where the generation of the excess power involves capital and operation charges exceeding $36 per year. Furthermore, it is safe to estimate that this means that one should not expend as much as $600 per horse-power for the development of excess power, since a cotton mill organization which can only net 6 per cent. on the investment which it has made for machinery and equipment had better use its money in a banking business and go out of manufacturing. In fact, it is unwise to develop the variable power of a river where the expenditure for this portion of the developing exceeds on the basis of twelve months' supply of power, $200 per horse-power, or, in other words, $100 per horse-power for six months' power, or about $150 per horse-power for nine months' power. But it is economical to develop the variable power where the continuous power does not exceed in cost $300 per horse-power, and the variable power does not exceed $200 per horse-power, based upon a continuous rate.

It has been stated that the development for continuous power at a cost not exceeding $300 per horse-power produces energy at a rate with which steam plants cannot compete successfully, no matter what the cost of fuel. Dr. Perrine said he is further of the opinion that where the excess power for a development does not cost more than $200 per horse-power it more than pays for the saving in fuel alone, and that this condition warrants the development of this excess power and the installation of a steam plant to be operated only during the time of the deficiency of water. As these opinions may not be easily justified in the installation of the plants having less than 1,000 hp minimum capacity, and as the majority of mills and water powers to which the argument might apply are of less capacity than this, it may at first sight seem that the arguments which have been presented have no particular or general interest; but before hastily arriving at this conclusion, attention should be given to the fact that the development, generation and distribution of power is no more the business of a cotton mill than making investments of a banking character would be.

Cotton mills have been built up along the water powers of New England, and as a consequence we find everywhere wasteful and expensive development of power, a lack of proper railroad facilities and a general disregard for manufacturing convenience in consequence of a choice of site rendered necessary by the domination of the needs of past methods of water power development. Dr. Perrine advocated a centralized plant, developing power for the use of many cotton mills. In many cases this means the purchase of power from a concern altogether independent of the mill itself, though in the future central power plants may be owned by the cotton mills, precisely as they own their insurance companies to-day, with a separate and efficient management and with a common interest and aim. The development of the water powers in large units and not in small units, with auxiliary central steam plants, will permit at all times the distribution of constant power to the mills and the consequent location of the mill with reference to their product and operatives and not with reference to the power. In order to do this it is necessary to abandon the developments of small individual falls and to substitute therefor the unification of many falls into one high head power wherever this can be accomplished by the means of flumes or dams. Whether this shall be done by the individual mills or a separate water power company owned by the mills is a question for each individual case. Generally, in sections thickly covered by mills and intersected by power streams there is no doubt what the central plant can easily utilize and concentrate all powers within a radius of 35 miles, tying the auxiliary steam plants and water power plants together by transmission lines so that the mills will be free, not only from the variation in the water supply but also from interruption of service due to breakdowns of machinery.

It may be objected that the opportunities for accomplishing this have most of them altogether disappeared. This, indeed, is regretfully true, but it is not altogether true, and there are to-day many streams throughout New England undeveloped on account of their fancied inaccessibility, which can readily become available if the question of the possibility of the site of the mill near the water power be considered as unimportant, and if transmission distances of from twenty-five to thirty-five miles be contemplated.

The development of water powers at high heads has not only advantages on account of the fact that the inefficiency of many small wheels is eliminated, but also from the standpoint of the storage reservoir, since with the high heads that are sometimes reasonably available the quantity of water necessary to develop a large power is so much reduced that reservoirs become important, which under low heads are of inconsiderable capacity. Along the Boston & Albany Railroad, between Becket and Chester, is to be seen an opportunity of carrying out such a plan as is here in mind. Whether the water in the Westfield River is sufficient for any development may be a question, but it is assumed that the water is in reasonable quantity, as it is used to operate several mills a little below. It will be observed as in traveling along the railroad that a canal of about five miles in length along the hillside would give at its lower end a head of approximately 400 ft., and although there are no mill sites in the immediate neighborhood of such a possible power plant, there are good mill locations within ten miles down the valley.

In the vicinity of the mills at Dalton is one of the best reservoir sites in the New England States, probably rendered forever unavailable by reason of the presence of Crane's Pioneer and Berkshire mills at the bottom of what might have been a reservoir backing up the water beyond Weston's mill and turning this little branch of the Housatonic from a power stream of comparative insignificance into a stream giving a large continuous water power.

Down the Housatonic River at Glendale are two powers which have practically been abandoned—that at Glendale and the one at Challenders. The configuration of the ground is such that not only these two powers might be united, but if it were not for the present development of the river, many feet additional head could be obtained in consolidating the heads by fluming the river for a distance of ten or fifteen miles.

The disadvantage of the location of mills along the rivers is most beautifully shown in the neighboring cities of North Adams and Adams, where there are mill after mill with foundations sunk in the river beds at a very considerable expense, and where once every five or ten years great repair bills on account of floods are encountered, though the configuration of the ground is such as would have permitted the consolidation of the water powers into one large efficient central station plant.

The most notable example of the wastefulness of low-head development is to be found at Holyoke, where the canals consume space which should be available for good factory sites, and where they are losing from 20 per cent. to 25 per cent. of the entire power developed by reason of the inefficiency of many low-head wheels in series. It would not be correct to object that in such a case as that of Holyoke the inefficiency of electrical machinery and transmission would more than counterbalance the increased efficiency of the waterwheels, since

we all know that the introduction of the electrical drive will of itself overcome the loss from belting amounting to more than the loss incident to the electrical machinery, and whatever increased efficiency there could be gained by the high head would be clear gain and increased power.

The present day marks an era of consolidation and specialization, and all that has been said is in direct line with this tendency, and is hardly more than calling attention to the fact of the improvements in hydraulics and hydraulic machinery, electrical generation, transmission and application, and the great change now made possible in the methods of power application over anything that has been seen heretofore in New England.

The advantage of these principles has been widely appreciated in the regions of the Rocky Mountains and beyond, and by their application the manufacturers of these regions have succeeded in overcoming their very great disadvantage of inaccessibility and expensive fuel, even where they have had to run flumes and ditches from five to fifty miles in length, and have had to transmit power to such great distances that the limit set of thirty-five miles seems to the Western engineers so short that they do not hesitate at rendering available powers that are at least 100 miles from a possible market.

The reception of the ideas outlined will eliminate many of the present difficulties met in New England from the gradual increase in price of coal, and will tend to solve also some of the questions that are so serious which present themselves with reference to the labor problem, and will aid New England in retaining its cotton manufacturing business, which during the past generation has been so important in its development and prosperity.

Electro-Hydraulics and Street Railway Operation.

As noted briefly in these pages last week, one of the papers read before the New York State Street Railway Association was by Mr. C. E. Parsons, of Glens Falls, on hydraulics in connection with street railway operation. He gave some interesting details with regard to work in his own vicinity, and said:

"The new hydro-electric development at Spier Falls on the Hudson River is to play a most important part in the operation of the street railways in the eastern part of the State. Some of the features of this plant, and of the one at Mechanicsville, together with their various transmission systems, give an idea of what may be done in reducing the cost of energy as used for electric traction.

"Within the last year a complete system of connecting railways has been put in operation in the Hudson and Mohawk Valleys, and lines now run from Gloversville in the west to Albany and Hudson in the east and south, and Lake George on the north, while all of the intervening cities have the benefit of the most modern electric railway engineering and construction. Six different railway systems are located within a radius of 45 miles of the Spier Falls plant. The Hudson Valley Railway connects Albany and Warrensburg and the adjoining villages. The Ballston Terminal Railway connects the various manufacturing villages in the vicinity of Ballston. The United Traction Company's lines are located in Albany, Troy and vicinity. The Albany & Hudson Railway's third-rail system covers the territory from Albany south to Hudson. The Schenectady Railway Company operates lines between Schenectady, Albany and Troy, and has nearly completed a line to Ballston and Saratoga. The Fonda, Johnstown & Gloversville Railroad covers 34 miles of territory between Gloversville and Schenectady.

"Three of these systems are now using power from Spier Falls and Mechanicsville. The Hudson Valley Railway is connected with the Glens Falls transmission line at Glens Falls. The voltage on this line is 20,000, and part of the current is used in rotaries at this point. The remainder is transmitted over the company's high-tension lines located on the right of way to the Wilton sub-station. The 18-mile line from Saratoga to Glens Falls is supplied from the rotaries at this station. The railway company has a complete system of high-tension lines, and connections may be made with very little additional copper, so that the whole 125 miles of line may be operated from Spier Falls. The United Traction Company of Albany is under contract to take 6,000 hp at its sub-stations in Watervliet and Albany, and a large part of this power is now being supplied. The Schenectady Railway Company is receiving power over three separate transmission lines. Two are from the Mechanicsville plant at 10,000 volts, and one from Spier Falls at 30,000 volts. These lines reach sub-stations at Latham's Corners on the Troy branch, Colonie on the Albany branch, and the Dock Street Station in Schenectady. The railway company also has a 10,000-volt transmission system connected to its steam plant.

"With the prospect of so much of the energy being used from Spier Falls for railway purposes, it became of the utmost importance that a reliable and constant supply should be assured. The one object which of all others has been kept in view since the very inception of this water power development was to so build that the supply of power would never fail.

"One of the first questions to be decided in a water power plant is the size of the units, both of wheels and of generators. The Spier Falls plant is laid out with four more generators than can be run in extreme low water. This gives a spare set of generators during the low water months, and provides for the sale of 30 per cent. more power during the eight months of the year when the supply is abundant. Another feature which also applies to most plants is that of the construction of storage reservoirs to regulate the flow during the summer months. It is easier to provide for additional units to be supplied from this storage, while the first part of the plant is under construction, than at some future time, when foundations would have to be put in with the aid of cofferdams. The additional cost of the masonry and rock work for spare units is small, as compared with the expense of a shut-down, if future extensions are found to be desirable.

"In regard to the question of the comparative size of water wheels and generators there seems to be a difference of opinion among designing engineers, and at first consideration it might seem as if there were no necessity for a wheel much larger than the generator. The Spier Falls wheels are built to develop 40 per cent. more power than the rated capacity of the generators, and the wisdom of such construction has already been demonstrated in the following manner: It became necessary, in order to fill power contracts, to start the generators before the dam was carried to its full height, and the wheels are now operated under a 64-ft. instead of an 80-ft. head. Because of their large capacity they are able to maintain the speed and develop the full rated power of the generators, although the head is 20 per cent. less than that for which the wheels were designed.

"The protection of the canal and forebay is a most important feature, and a thorough study of existing plants was made before the present layout was adopted. The canal and intake rack run parallel with the river, and the racks are made continuous, with ample space behind them. This gives a larger rack surface, and the velocity being correspondingly less, there is not so great a tendency for driftwood to choke the water supply. This arrangement allows the larger pieces of wood to be floated down the face of the racks, and over the wasteway at the end, instead of lifting them out bodily. A practice which should be avoided where feasible is that of placing the intake square across the current. If this is done heavy projecting piers must be built to take the ice thrust in times of high water.

"The plant at Mechanicsville, unfortunately, has this arrangement, and there was serious trouble with the ice almost every year, until a series of ice breakers was built diagonally across the river. In order to facilitate the making of repairs on the hydraulic equipment, and to enable any part of the system to be laid up without interrupting service, a series of grooves for stop logs was arranged, both for the canal head gates and for the gates in front of the penstocks, and any of the gates may now be repaired or replaced without affecting the others.

"The question of the governing of a plant is one to which altogether too little attention is usually given. It is impossible to attain accurate speed regulation with the best governor that can be built, unless due consideration has been given to the principles upon which depends the speed of a water wheel. The function of a governor is to vary the energy delivered to the wheel as the generator load changes, and this can be satisfactorily done only when the gates and gate rigging are so designed that they will respond quickly to the governing mechanism. The limitation of speed control is that imposed by the inertia of the water, and to obtain good governing the one most essential thing is for the water column to respond promptly to the varying aperture of the gates. It is to the water column, therefore, that attention should be given from the moment the plant is begun, if the accurate speed control which is now demanded is to be obtained. The shorter the penstock, the sharper the downward pitch, and the less the velocity, the better on the whole will be the regulation.

"It must be remembered also that the water column does not end at the gate; and long and contracted draft tubes and shallow tail-races may have a serious effect on the governing, even if the work above the wheel is correctly planned. Frequent cause of disaster is the sudden and dangerous rise of pressure in the penstock, due to sudden closing of the gates, and there seem to be but two practical methods of eliminating this danger. Standpipes are effective if properly built, but are expensive and a source of trouble in cold climates. The problem seems to be solved at Spier Falls by the use of Lombard relief valves. They are easily adjusted, open and close quickly and have a discharge area large enough to afford ample protection. As a result of a study of the foregoing principles and of the adoption of the most modern governors, the regulation of the Spier Falls plant is very satisfactory.

"The switchboard is another part of the system which needs to be carefully studied if shut-downs are to be reduced to a minimum, and the one at Spier Falls is to be modern in every respect. It will be possible to put any one of the ten machines on any one of the eight outgoing circuits, by means of the small controlling switches on the operating board in the center of the station. Consequently, in case of trouble with the generators, there will be no delay in changing. The transmission lines are all to be built in duplicate, and two separate pole lines, running through different sections of the country, will reach the larger centers of power distribution.

"There is a great deal of scepticism among railway managers in the East, as to the reliability of water power as applied to electric traction. This is largely due to the fact that designing engineers have not given the proper study to their hydro-electric developments, and numerous shut-downs and poor regulation have caused the more conservative to withhold their approval. From the results which will be attained in the Spier Falls plant, and in other modern plants of this character, under construction, it seems safe to predict that water power will be as reliable as steam, with the additional advantage of a saving of 50 per cent. in the cost of energy."

New Telephone Patents.

CALL REGISTERING SYSTEM.

The proportioning of telephone charges to the amount of service given has always been a rather knotty problem. The flat or unlimited system of charging of course makes no attempt at such equalization, while the more modern message rate system is far from perfect in this direction. Slot machine service, as given in many cities, does equalize the charges fairly well, but it cannot be perfect in this direction so long as one does not pay something for "busy" calls. For instance, suppose A to make five attempts to call per day, but owing to the class of subscribers called but one of these is successful. On the other hand, suppose B to call but twice a day and both calls are successful. Now every attempt to make a call by A has taken part of the time of his operator, and as this must be paid for in some manner by the subscribers, it is evident that were A and B the only subscribers on the system a large proportion of B's payment for his two good calls would go toward paying for A's failures to complete his one call. A system of registering calls recently patented by Albert J. Springborn contemplates a differentiation between successful and unsuccessful calls. These are scored separately upon two counters. These counters are located at the subscriber's premises—one, that for good calls, being operated automatically; and the second, for lost calls, being under the control of the central office operator. Unfortunately, the present development of the system is rather of the laboratory than of the practical type, as there is at each subscriber's station such an abundance of coils, contacts and levers as to render the maintenance system a disadvantage far beyond any saving which it could possibly introduce.

SELF-RELEASING INTERCOMMUNICATING SWITCH.

George F. Archer, of New York, is the patentee of an automatically releasing intercommunicating system switch. With this switch each line terminates in a spring member, the end of which plays across a latch member. When a line is desired the corresponding spring member is depressed beyond the latch to a stop member, to which the signal battery is connected. When it is released it returns to the latch, thereby completing the talking circuit to the desired line. If the receiver be returned to the hook, or if a second line spring be depressed, then the latch will tilt and release any spring previously latched.

BELL YOKE ADJUSTMENT.

One of the primary adjustments of a polarized bell is that controlling the distances between the armature and pole faces of the core and between the armature and the free pole of the polarizing permanent magnet. As in almost all bells of this type, the armature is carried by a yoke spanning the longitudinal frame members, this adjustment is well termed the yoke adjustment. A common practice in providing for this yoke movement is the threading of the longitudinal members which pass through the yoke ends, one nut being placed on each side of the yoke. This certainly provides a secure, if rather awkward, adjustment. Frank B. Cook, of Chicago, has recently obtained a patent for another means of yoke adjustment, by which the movement of the yoke is facilitated. In this bell the longitudinal members are cut off at about the level of the pole faces. These ends are then drilled and tapped to receive screws which pass through the yoke. These screws are quite long and after passing through the yoke they are threaded through spiral springs. These latter hold the yoke against the screw heads, while at the same time permitting of a considerable range of motion of the yoke.

CURRENT NEWS AND NOTES.

CHICAGO BRANCH A. I. E. E.—Mr. P. Junkersfeld, local secretary, announces the appointment of the following members to the Executive Committee of the Chicago branch of the American Institute of Electrical Engineers: Messrs. George A. Damon, James Lyman, H. H. Wait, Kempster B. Miller, Prof. P. B. Woodworth, J. R. Cravath and T. P. Gaylord. Arrangements for the fall programme are to be made at an early date

MAIL BY TELEPHONE.—It is stated that Senator Fairbanks, of Indiana, as soon as the regular session of Congress convenes, will take up a matter in which he is much interested. Just before the adjournment last spring he offered a resolution calling upon the Postal Department to investigate the feasibility of using the telephone in the delivery of special delivery letters. The Senate would not make an appropriation at that time, as the proposition was new. Senator Fairbanks talks enthusiastically of the matter. He believes that the adoption of the rural telephone will make it possible for the farmer to receive his mail as quickly as the man in town. He would have it arranged so that the postmaster could open the special delivery letter, and read it over the telephone to the man in the country. The rapid extension of telephone lines through the rural districts makes the scheme more easy than it would have been at the time he prepared it. He has talked with merchants and farmers and members of the Post Office Department, and they are all in favor of the plan. He says he intends to push the matter as rapidly as possible.

ELECTRIC VAPOR LAMPS.—Two patents were recently granted to Mr. Peter Cooper Hewitt for improvements in his electric vapor lamp. While the old familiar type of this lamp is held in a vertical position, Mr. Cooper Hewitt has found that operation in a horizontal position has certain advantages, and has now patented details of construction for this purpose. It is stated that a horizontally-disposed lamp having a luminous element of considerable length placed in the upper part of a room furnishes a kind of illumination which is agreeable to the eye and is well adapted to display the special features of architecture, decoration or furniture, and at the same time the light is said to be agreeable for reading purposes. The other patent relates to details of construction which improve the method of starting the mercury vapor lamp. By adding certain other materials, such, for instance, as red sulphide of mercury, during the manufacture of the lamp, a condition is produced within the lamp which facilitates the starting, a much lower potential being sufficient than if such material is not present. It is also of advantage to provide a band of foil in proximity of the negative electrode and in electrical connection with the positive electrode. To start the lamp, it is connected to a special circuit having a higher potential than that upon which the lamp is intended to run after it has been started, this higher potential being produced by a spark coil.

MASSACHUSETTS STREET RAILWAYS.—At the annual meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, the following officers were elected: President, Edward P. Shaw, of Newburyport; first vice-president, Francis H. Dewey, of Worcester; second vice-president, Robert S. Goff, of Fall River; treasurer, Fred H. Smith, of Quincy; secretary, Charles S. Clark, of Boston. Executive Committee, the president, vice-presidents and H. H. Crapo, of New Bedford; P. F. Sullivan, of Lowell; W. S. Loomis, of Holyoke; W. W. Sargent, of Fitchburg, and R. T. Laffin, of Worcester The following were elected Auditing Committee: Charles F. Grosvenor, of Palmer; George W. Cook, of Springfield, and H. C. Page, of Pittsfield.

N. E. L. A.—President Edgar accomplished a good deal of work for the association during a visit to New York last week. He has completed the organization of the committee for the investigation of the steam turbine, and a meeting will be held at an early date to formulate a plan for immediate and thorough work. The association made a large appropriation for this work at the Chicago meeting, believing it to be one of great importance to the members; and in the hands of the men composing the committee the investigation is sure to result in a valuable report for the Boston meeting. The following gentlemen have consented to take up this work: Mr. Wm. C. L. Eglin, Philadelphia, chairman; Mr. Frederic Sargent, Chicago, and Mr. A. C. Dunham, Hartford.

A GREAT STORM.—The Atlantic seaboard—particularly the States of New York and New Jersey—was visited by a tremendous rainstorm last week, lasting virtually from Thursday to Saturday, and doing immense damage. Work was interrupted at the General Electric factories, Schenectady, by the rising of the Mohawk River. The electric power dam at Port Jervis, N. J., broke away and damage was inflicted on the plant of the Neversink Light & Power Company. At various points along the Hudson River electric light and power plants were submerged and silenced, and the same is true of the system of the Public Service Corporation, in New Jersey, whose plants border the Passaic. Serious trouble of the same kind was experienced at Scranton, Pa. In several places, including New York City, the street railway systems were tied up or badly restricted.

MARCONI AT WORK.—When the steamship *Campania* arrived in New York Harbor on Saturday last it was learned that Mr. Marconi had been successful in his latest wireless telegraph experiments. The steamship *Lucania,* with the inventor on board, and with special apparatus, sailed from New York on October 3, when Mr. Marconi said that he would attempt to communicate with one of the land stations all the way over, receiving everything they sent. His success was announced in a wireless telegraph "extra," which was printed on the *Campania* in midocean on Wednesday morning, shortly after the two ships passed. The *Lucania* at that time was in communication with the land station, and had been since leaving Sandy Hook. She conveyed all of the latest news of the world to the *Campania.* As soon as the *Campania* had received the news from the *Lucania,* Purser Graham assumed the rôle of editor, and with the aid of several of the other members of the crew, published an early morning extra. The paper was given to the passengers at breakfast, with the information that it was the first thing of the kind ever done at sea. Such "relaying" is a very effective demonstration of the immense possibilities of wireless telegraphy.

STREET RAILWAY PENSIONS.—At the recent annual meeting of the Metropolitan Street Railway Association—the benefit organization of the New York street railway interests—President Vreeland said: "Referring to the pension system in combination with the association, from the time a man enters the service of the company, until the time of his death, he is properly cared for, the pension system stepping in where the association leaves off when a man becomes incapacitated for active labor. It has also been made a rule that all of the lighter grades of work, such as transfer agents, janitors, watchmen, etc., are reserved for men in the service of the company who, either on account of age or injury, have become incapacitated for the more active service. This is in direct contrast with the system in vogue years ago, when influence had much to do with the placing of men in these positions, employees of many years of service being forced out with no means of support. As an illustration of the workings of the pension system, an employee with an annual salary of $900, who receives 40 per cent. of that average salary through pensions, would receive $360 per year. This is the interest, at 4 per cent., on $9,000, a sum which a man living in a thrifty manner, would be unlikely to save during his active service."

AMERICANS AS ENGLISHMEN.—Our London contemporary, *Electrical Times,* comments amusingly on the industrial invasion of England by Americans. Anywhere, it says, between Maine and Manila, it is allowed to be the manifest destiny of America to dominate the world. "The preliminary step is the invasion and industrial conquest of this country. After that the rest is easy. Resistance is futile, owing to the difficulty of distinguishing the invader from a true-born Englishman after he has been six months on this side. Sometimes one has not to wait so long. Until last week if there were wanted for polemical purposes a well-established landmark of the progress of the American invasion, it could have been found in the acquisition by the American storage battery interest of the Chloride Company at Manchester. It was all in the New York papers, and, besides, directors of the Electric Storage Battery Company, of Philadelphia, were made directors of the English company, so there could be no doubt of it. The English company held its annual meeting at Clifton Junction last week, and there was Mr. Herbert Lloyd, the president of the Philadelphia company. In accordance with dramatic propriety he should have forthwith ordered the stars and stripes to be hoisted over the company's new offices. Nothing of the kind: he simply intimated to the assembled shareholders that he had been raised in the old country, and was, as a matter of fact, a real Britisher. Moreover, the other director, who resided in America, was also an Englishman, and the American company was not run by Americans, but by Englishmen. It was he who had invaded America twenty years ago, and now came back with the experience of those twenty years to give the mother country the benefit of it. Now, what is to be done with an invasion which is not an invasion, but simply the return of the native? One of my colleagues has started off on a research designed to establish the proportion of eminent American electricians that were born under the British flag, and he tells me the results are surprising, but I don't trust him. It does not seem safe in this matter to trust anybody."

LETTERS TO THE EDITORS.

Theories in Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

SIRS:—I notice that in your issue of September 19 last, page 474, reference is made by Mr. A. F. Collins to Prof. Fessenden's "Sliding half-wave" theory.

I have on other occasions refrained from making any comments when various names have been put forward as the originators of this theory, but feel impelled in this instance to point out that the theory in question did not originate with Prof. Fessenden, as he himself will no doubt be the first to admit.

So far as I am aware, the theory was first propounded by myself in articles published in the *London Electrical Review,* of May 12 and 19, 1899.

The first mention of the theory by Prof. Fessenden appears to have been made at a meeting of the American Institute of Electrical Engineers in November of the same year, as will be found on reference to the *Transactions* of the Institute.

LONDON, ENGLAND. J. E. TAYLOR.

Boyleiana.

To the Editors of Electrical World and Engineer:

SIRS:—Having had occasion to consult the 1774 edition of Boyle's works recently presented to the Library of the American Institute of Electrical Engineers by Dr. S. S. Wheeler, it occurred to me that the following notes might be of interest to the general scientific reader:

(1). In the life of Boyle by Dr. Birch, which forms the first 94 pages of this fine quarto edition, will be found on page 70 a letter from Sir Isaac Newton to the philosopher of Lismore on the prop-

erties of the ether, which hypothetical substance is there held to be "capable of contraction and dilatation, strongly elastic, and in a word much like air in all respects, but far more subtile."

(2). The tract on the "Mechanical Origin of Electricity," Vol. III, p. 647, is of historic interest, being the first work (1675) written in English on the subject of electricity. Gilbert's famous work (1600) contains a very important chapter on electricity, but written, like the rest of "De Magnete," in Latin.

(3). In his "Experimenta et Observationes Physicæ," Vol. V, p. 81, Boyle makes the curious remark that a brick rendered red hot and then allowed to cool while lying in the magnetic meridian acquires "magnetical verticity."

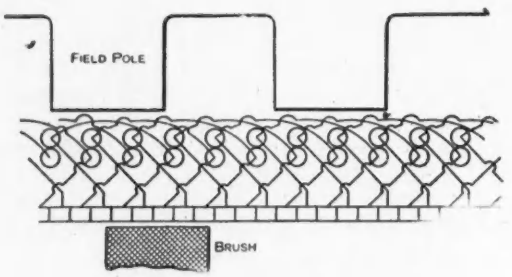
(4). Vol. V contains a paper entitled "A short account of the statical baroscope imparted by Mr. Boyle, March 24, 1665." This letter, written by Boyle to Mr. Oldenburgh, is especially interesting from the fact that in it we meet for the first time the term *barometer* (see page 133).

MANHATTAN COLLEGE, NEW YORK. B. POTAMIAN.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Single-Phase Repulsion Motor.—CRAMP.—The author describes in a general way his construction of a single-phase repulsion motor. He believes that repulsion motors may be built up to at least 20 hp, which will compare favorably with any type of motor at present in use. In the first form of repulsion motor which he tried he found that the spark was almost as great on closing the coil as on opening it. He found that on the whole, to avoid sparking on the make, a good, firm, clean, low-resistance contact is adequate; this could be obtained by copper brushes. He was enabled to obtain sparkless opening by means of the same principles that are employed in what is known as "resistance commutation"; that is, by providing a sufficient interpolar space to enable each rotor coil to pass entirely outside the magnetic field, so that the current can die down before the opening of the circuit. Of the two forms of commutation to be adopted in the design of a repulsion motor, namely, resistance or e.m.f. commutation, the author states that he tried both forms, and finds that while both may be rendered sparkless between certain limits, the former gives good commutation over a wider range, while the latter gives better starting torque and a better power factor. As far as the design of the rotor winding is concerned, the author illustrates two arrangements, in the first of which all short-circuited coils are in series, while they are in parallel in the second. All motors at present under construction are of the first type, while with the second class of windings it has been found that if the rotor is of the closed-coil type, besides those coils actually short-circuited, there are other closed circuits carrying useless or even harmful currents. Most of



SINGLE-PHASE REPULSION MOTOR.

his experiments were made with a type illustrated in the adjoining figure, in which the rotor is practically converted into an open-coil armature, with two coils in parallel. He then discusses theoretically the e.m.f., current, torque, etc., with the help of diagrams. As far as efficiency is concerned, the author does not give definite figures, but states that the repulsion motor for a given power will be heavier than the corresponding polyphase motor, and lighter than the single-phase motor with its starting apparatus. Considering the enormous waste of energy in starting the latter, the repulsion motor will be far more economical of energy for non-continuous running. The great advantage of the repulsion type of motor is that it may be started under full load, with a current only slightly exceeding the full load current, without any expensive and cumbersome starting arrangement. If maximum torque of the motor is required at starting, and the brushes are to be kept fixed, the power factor can never exceed 70 per cent. At any speed the torque will always be a maximum with about this power factor, but in order to keep this maximum the brushes would have to be moved gradually in the direction of rotation as the speed rose. The author sees no reason why this should not be done either automatically or by hand, in the case of small motors.—Lond. *Elec.*, September 25.

POWER.

Three-Phase Motors for Electrical Driving.—EBORALL.—The continuation of his paper, previously mentioned in the Digest, on the application of three-phase motors to the electrical driving of workshops and factories. The use of a rotor resistance, according to the author, presents the advantages that the current consumption for a given torque is greatly reduced and the power factor of the starting current attains a high value, approximating to the value it has when the motor is running well loaded. The starting is gradual, in accordance with the requirements of the load, and it is perfectly under the control of the operator. Test curves are given of the running and starting performance of three-phase, 15 and 30-hp motors, with wound rotors. Such motors start with a torque equal to that at full load, with a starting current a little in excess of the full load current; they can, if desired, start with more than twice the full load torque, and then the current consumption is two and a quarter to two and a half times the full load running current. The starting performance of three-phase slip ring motors, as compared with direct-current motors, is also illustrated by curves. The author then discusses the question of speed regulation, the slip ring type of motor being the only one which can be employed in this connection. He concludes that for all practical purposes rheostatic (rotor) control is the only method of general application, which is available at the present time for varying the speed of three-phase motors. He gives the diagram of connections for a three-motor crane, each of the three-phase motors having its own controller and resistance. The controllers are represented in the form of developed diagrams.—Lond. *Elec.*, September 18.

Distribution of Electric Power and Lighting.—A description of the system adopted for the distribution of power and lighting in the new locomotive shops of the Philadelphia & Reading Railway, at Reading, Pa. The reasons are given in detail, which led the management to choose the two-phase alternating-current system of power distribution, with two-phase generators, as best suited to the local conditions. For lighting purposes the series, enclosed, 6.6-amp., alternating-current lamp was adopted for both inside and outside use. Both alternating and direct current are furnished, the former for driving induction motors on all machinery requiring constant-speed driving, the latter for cranes and variable-speed motors on individually-driven tools. A frequency of 60 cycles at 480 volts was adopted. The construction of the wiring tunnel leading from the power house to the shops is described and illustrated.—*Am. Eng. & Rail. Jour.*, October.

Motor-Driven Chasing Lathe.—A short illustrated description of a recent English construction. The fast head-stock casting is so arranged as to form a bedplate for the motor, which drives the spindle by means of rawhide spur gearing. The machine is specially designed for the rapid production of fire box stays in brass, copper or bronze, and a small pump, driven from the motor shaft, is used for flooding the tools while making a cut.—*Eng'ing*, September 25.

Electrically-Driven Quartering Machine.—An illustrated description of an interesting new design for mounting electric motors for driving a machine for quartering and boring crankpin holes in locomotive driving wheels. The machine is driven individually at each head by 3½ hp constant-speed motors. The most important feature of the design is the simplicity of the construction for changing around

for quartering with left instead of right-hand lead, without altering the relative locations and the principal dimensions of the drive.—*Am. Eng. & Rail. Jour.*, October.

REFERENCES.

Application of Induction Motors.—A note on the electrical equipment of a cement factory. The plant includes ten variable-speed induction motors, each of them direct-geared to a rotary kiln and provided with a controller permitting the motor to be run at any one of four speeds; the note does not describe how it is done. The operation of the kilns by variable-speed induction motors is said to be a new departure from the usual method of applying power to this class of machines.—*Engineer*, October 1.

Coal-Handling Machinery Driven by Electric Motors.—WILLEY.—An illustrated description of the installation of the Maryland Steel Company, at Sparrow's Point, Md.—*Elec. Rev.*, September 19.

Alternating Versus Direct Current for Mines and Smelters.—BROWN.—An article on the relative advantage of 2,300 volts alternating current versus 550 volts direct current for mine and smelter work, in which the author enumerates the various advantages and disadvantages of each system. He concludes that no hard and fast rules can be laid down to determine the question, as it depends upon local conditions.—*Eng. & Mining Journal*, September 26.

Motor-Driven Machine Tools.—An illustrated description of recent practice in the application of electric driving to drilling machinery.—*Am. Eng. & Rail. Jour.*, October.

European Electrically-Operated Cranes.—PERKINS.—An illustrated description of several constructions.—*Elec. Rev.*, October 3.

TRACTION.

New Power Station at Brussels.—An illustrated description of the power station which has just been put in operation and is intended to distribute polyphase current to three sub-stations to operate the entire tramway system in Brussels. The sub-stations are located in the old direct-current stations, which are to be given up, but the old direct-current feeders will be used. The station contains at present four 1,500-kw alternators generating current at 6,600 volts and 25 cycles. Each alternator is operated by a twin, tandem-compound condensing engine, with cylinder dimensions 630 mm. and 1,090 mm. by 1,200 mm. stroke. These engines operate at 94 r.p.m., with a pressure of nine atmospheres and an admission temperature of the steam of from 275 to 300° C. The principal feature of the station is the switchboard, which consists of three sections. The apparatus for the low-tension, direct-current apparatus, such as the exciters, battery, lighting circuits and motors used around the station constitute one section. The second part of the switchboard is that for the operation of the high-tension switches. All of these switches are operated by low-tension circuits, and the low-tension apparatus for doing this work is mounted on a table in the center of the switchboard gallery. This table is also provided with rheostat connections for the alternators and with the controller for an especial electrical governing device on the engine governors. The third part of the switchboard includes the recording instruments, together with the automatic relays for operating the oil switches. The switchboard operator thus has all this apparatus in front of him and also has a clear view of the engine room. The bus-bars are divided into sections so that any feeder or leads from any machine can be switched to any section of the bus-bar.—*St. R'y Jour.*, October 3.

REFERENCES.

Colorado Springs & Interurban Railway System.—A description of the line which connects the cities of Colorado Springs, Colorado City and Manitou. The roadbed is built with a view of obtaining high speed. A new power house, new shops and new car houses have been erected recently, plans and views of all of which are presented. Three direct-connected generating units of 750 hp each furnish current for the railway plant, and an alternator has been installed to furnish current for lighting the buildings and the parks of the company.—*St. R'y Jour.*, October 3.

Notes on the Operating Practice of the Indiana Union Traction Company.—An article calling attention to a number of operating details which have been worked out on this important system, and which are of general interest for those who are engaged in the operation of interurban properties. The limited service established by this company is described, together with the train dispatching system and a number of features of construction and equipment.—*St. R'y Jour.*, October 3.

Electric Railways of Budapest.—KOESTER.—An illustrated description of the electric underground and surface roads. The power plant is briefly described.—*St. R'y Rev.*, September 20.

Columbus, London & Springfield Electric Railway.—REAGAN.—A long illustrated description of the system of the Columbus, London & Springfield, and the Dayton, Springfield & Urbana Railways. The mechanical and electrical equipment of the power house is described in detail.—*St. R'y Rev.*, September 20.

Electric Railways in the United States.—SERRELL.—A statistical article, reviewing the railroad situation from the investor's standpoint.—*Cassier's Mag.*, October.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Gas-Driven Electric Light Plant.—A short illustrated description of the plant of the Tunis (Algiers) Electric Light Plant, which is stated to offer special interest, because it affords the first instance in which a gas company has adopted producer gas and gas engines as the motive power for its electric station. There are three gas producers, a brief description of which is given, with coke scrubber and chemical purifier. The engine room contains four high-speed gas engines of 106 brake hp each, running four dynamos of 70 kw each at 240 volts. The engines can be run with producer gas or coal gas, and can be changed to either while running.—*Eng'ing*, September 25.

WIRES, WIRING AND CONDUITS.

Conductivity of Certain Aluminum Alloys.—WILSON.—A paper read before the recent meeting of the British Association on the electrical conductivity of certain aluminum alloys as affected by exposure to the London atmosphere. Specimens of various alloys in the form of wire of 0.126 in. diameter were placed on the roof of Kings College on June 11, 1901, taken down and tested after a year's exposure in 1902 and again in 1903. A table gives the results obtained. During the first year the series of copper aluminum alloys diminished in conductivity to a greater extent the greater the percentage of copper they contained. This process has progressed still further in the second year, though in a smaller percentage ratio. The manganese and the nickel series have changed very little. For exposed light aluminum alloys the results, therefore, confirm the conclusion previously arrived at, namely, that copper alone should not be used in comparatively large quantity.—Lond. *Elec.*, September 18.

REFERENCES.

Sag and Tension of Suspended Wires.—SENGEL.—A mathematical article containing a method of approximately calculating the new tensions and sagging which are produced through variations of temperature, load or distance between the poles. The calculations are made in the metric system.—*Elek. Zeit.*, September 24.

Bringing High-Tension Conductors into Buildings.—SKINNER.—A short illustrated discussion of the methods employed.—*St. R'y Rev.*, September 20.

ELECTRO-PHYSICS AND MAGNETISM.

Radioactivity of Metals in General.—VOLLER.—A discussion of the results obtained by McLennan and Burton, previously noted in the Digest. These experimenters found that metals like lead, aluminum, zinc, tin and copper send out spontaneously positive ions and retain, therefore, negative charges. They found negative potentials of 0.216 to 0.073 volts. The author calls attention to the fact that in electrometer measurements of such potentials, which are of the order of the Volta contact potentials, it is necessary to consider all electromotive forces which appear between the single metallic parts of the electrometer or the whole electrometer system, when they touch each other. In such cases the metals to be investigated and the metals of which the electrometer is composed have to be of the same nature. If, however, the electrometer quadrants were of brass there was always the voltaic electromotive force of brass against lead, aluminum, etc., acting in the system. These forces generate potentials, the value of which is equal to or greater than those measured by the first-named experimenters. If the above influence of the voltaic potentials has not been excluded, there is no necessity to assume a general and spontaneous electronic emanation of all metallic surfaces.—*Phys. Zeit.*, October 1.

Action of the Earth in the Propagation of Electric Waves.—VOLLER.—The author gives the result of experiments with a small Braun and Siemens-Halske apparatus, which was operated in four ways:

1, in the ordinary manner, with both air wires, without any earth connection; 2, without both air wires and with connecting wires to earth plates; 3, with replacement of sender or receiver wire respectively by earth connection; 4, without air wires or earth connections. He concludes that a variable electrification, communicated to the surface of the earth, is propagated by conduction in the latter in the same way as in a dielectric by progressive polarization, and that, therefore, a sort of wave telegraphy through the surface of the earth is possible.—*Phys. Zeit.*, October 1.

Action of X-Rays on Vapors.—CAMPANILE AND COMMO.—The authors investigated the property of condensing vapors possessed by air ionized by the X-rays. They established that the air which is traversed by X-rays has the property of condensing a sensitive ray of vapors, even of other liquids than water. The air traversed by X-rays also condenses such vapors, which are generated in the air, if a liquid is contained in an electrified metallic capsule. They confirmed that negative ions are more effective in producing condensation than positive ions.—*Phys. Zeit.*, September 15.

REFERENCES.

Losses by Hysteresis and Eddy Currents.—RICHTER.—A mathematical article, accompanied by diagrams, in which the author investigates the influence of the distribution of the lines of force in an iron ring on the losses by hysteresis and eddy currents. He finds that with an irregular distribution of the lines of force smaller iron losses are obtained than with regular distribution.—*Elek. Zeit.*, September 3.

Terrestrial Magnetism.—CREAK.—An abstract of an address before the British Association, on terrestrial magnetism in its relation to geography, reviewing the work done by magnetic surveys, the search for the magnetic poles of the earth, etc.—Lond. *Elec.*, September 18.

Alternating Currents.—TELL.—A didactic article on the elementary principles of alternating currents.—*Engineer*, September 15.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolysis and the Solvent.—LOBRY DE BRUYN.—An abstract of an article in which the author publishes the results of his endeavors to obtain quantitative data bearing upon the question as to whether the ions carry the solvent with them in electrolysis. This cannot be decided by using purely aqueous solutions, and, therefore, the author used a mixed solvent of water and alcohol. Then, if one of the ions carried with it one of the solvents, this would be found by the difference in the proportion of the two solvents at the cathode and at the anode. The electrolyte was silver nitrate dissolved in 25, 35 and 64 per cent. solutions of methyl alcohol, and silver electrodes were employed. The apparatus was such as is used for the determination of transference numbers of the ions. The result was distinctly negative. If the silver or the nitrogen oxide ion had carried with it one molecule of the solvent, then for every 4 grams of silver an increase or decrease of 0.6 to 0.7 grams of water or of about 1.2 grams of alcohol at the anode or cathode would have taken place. This would have been easily detected by analysis, even though the amount had been largely diminished by diffusion.—Lond. *Elec.*, September 18; from *Proc. Roy. Acad. Sc.*, Amsterdam, August 27.

REFERENCES.

Extraction of Mercury in the Electric Furnace.—BECKER.—A short, popular description of the ordinary chemical process of treating cinnabar and the advantages of the electric furnace, when used in this connection. It is proposed to heat the cinnabar together with lime.—*L'Ind. Electro-Chimique*, September.

Quantitative Electrolytic Precipitation of Metals.—NISSENSON AND DANNEEL.—A paper read before the Congress of Applied Chemistry at Berlin on the quantitative precipitation and separation of metals by electrolysis, for analytical purposes. The authors give methods of determination for lead, copper, antimony, tin, cobalt, nickel, zinc, and cadmium.—*Zeit. f. Electrochem.*, September 10.

Manufacture of Metallic Powders.—A short review of several electrothermic processes for the manufacture of metallic powders.—*L'Ind. Electro-Chimique*, September.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Resistance of Highly Insulating Substances to Perforation.—WALTER.—A very long article in which the author describes in detail a method which he has worked out for testing strongly insulating substances in order to ascertain the resistance which they offer to perforation. He calls attention to the fact that different insulating substances show considerable differences as far as their specific resistances are concerned, but that their resistances to perforation are not nearly as different. The method is founded on the discovery that a rather thick plate of an insulating substance can be easily perforated by the following method: A drop of wax, stearin or similar substance is brought on one side of it and after it has become cold is perforated with a fine needle, until the surface of the plate is reached, and the whole brought between two electrodes, which are connected with the poles of a high-pressure machine, or an induction apparatus. The arrangement must be such that the perforation in the drop is in line with the two electrodes, and the latter are about 1 mm. distant from the plate, on each side. It is then possible to perforate the plate in a direction representing the continuation of the perforation in the drop of wax, even with a comparatively low potential measured by a spark-gap connected in parallel. The author found that for a certain plate of insulating material there was always a certain minimum length of spark, with which the perforation is just possible, and that this minimum spark length increases proportionately with the thickness of the plate. An induction apparatus of 20 to 30 cm. length of spark is sufficient for several millimeters' thickness of insulation. The arrangement of the apparatus and the method of carrying out the determination is discussed by the author at considerable length, as the exactness of the experiments depends largely on conforming to the proper conditions. For glass plates of various thicknesses and composition, the author found that the composition of the glass is not to be neglected, as the resistance to perforation of plates which contained a larger amount of lead was considerably less. He mentions in this connection the interesting fact that the dielectric constant of a glass containing 45 per cent. of lead is almost the same as that of a glass which contains no lead. He also gives experimental results on a number of hard rubber plates and hard porcelain plates. He also conducted an extended series of experiments with mica and micanite plates, the behavior of which was found to be different from that of the other plates, in so far as this material consists of several superposed pieces of mica, separated partly from each other by air cavities. The drop method in such a case will not lead to a perforation of the whole plate, but only of the upper pieces of mica, up to the next air cavity, in which the electricity then spreads to all sides. The practical value of the results consists in the comparison of the qualities of the different materials and the possibility of calculating the minimum thickness of a layer of insulating material.—*Elek. Zeit.*, September 24.

Measurement of Electromagnetic Radiation.—HUTH.—The author describes an oscillation galvanometer, devised by himself, for the measurement of electromagnetic radiation. The instrument is shown in the adjoining figure. It consists of a bundle, *a*, of steel wires of 0.1 mm. diameter, and 16 mm. length, which is carried by an ivory rod suspended at *f* by a phosphor-bronze wire, *c*. The lower cord of the rod is fastened by a phosphor-bronze spiral, *d*, on the base plate of the instrument at *g*; *p*, *p* are damping wings of paper, *e* is a storage battery, which furnishes magnetizing current for the bundle. The current goes from *e* over *f* and *c* through the magnetizing spiral, *b*, through the torsion spiral, *d*, and returns over *g* to *e*. Parallel to this circuit are arranged the antennæ, which are indicated at *f* as air wire, and at *g* as earth connection. The measurement takes place as follows: The bundle, *a*, is first magnetized and endeavors to arrange itself in the magnetic meridian, thereby subjecting the spiral, *d*, to torsion. If now, after the magnetizing current has been opened, electric waves strike the antennæ, and demagnetize the bundle, the disturbance of the magnetic equilibrium is followed by a turning of the movable system, which is measured in the usual way by means of the mirror, *S*, and a scale.—*Phys. Zeit.*, September 15.

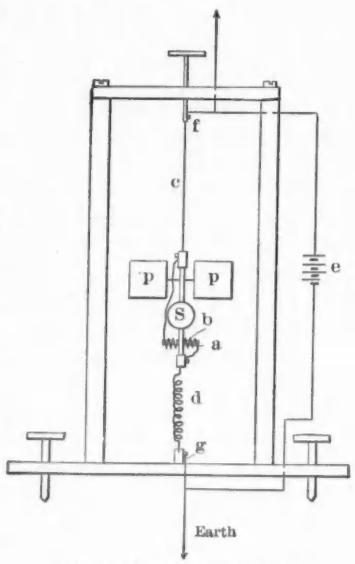


DIAGRAM OF INSTRUMENT.

Method for Finding the Efficiency of Series Motors.—WILSON.—A paper read before the British Association at its recent meeting. The

method is stated by the author to be of great accuracy and to have been found to work well in practice. The diagram of connections is given in the adjoining figure. *M* and *G* are two like machines mechanically coupled together with or without gearing, according as the efficiency of either machine with or without gearing is to be obtained. In the test *M* runs as a motor and delivers current to *G* running as generator. The field coils, F_1 and F_2, are in series with one another and the motor armature, in order that each machine

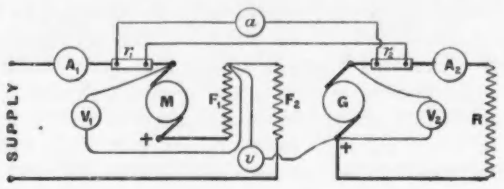


DIAGRAM OF CONNECTIONS.

may be conveniently magnetized to the same degree. The input of the motor is measured on the voltmeter, V_1, and ammeter, A_1. The generator is loaded on a resistance, *R*, and its output measured on the voltmeter, V_2, and the ammeter, A_2. If R_1 and R_2 are the ohmic resistances of the motor and generator armatures respectively, then $V_1A_1 - V_2A_2 = X$ are the total watts dissipated in the system, exclusive of the generator field coil, F_2. Of these $A_1^2(F_1 + R_1) + A_2^2R_2 = Y$ are the ohmic resistance losses in watts and $X - Y$ are the watts due to brush, bearing and wind friction, eddy currents and magnetic hysteresis. The machines are equal and rotate at the same speed. $(X - Y)/2$ are the watts which can be debited to each machine, when calculating the efficiency, it being assumed that the brush contact resistance has the same value as when measured with the machines at rest, and that armature reaction does not produce inequality in the watts dissipated by eddy currents and magnetic hysteresis in the two machines. The expressions for the efficiency are, for the motor $(X - Y)/2 + V_2A_2 + A_2^2R_2/V_1A_1$, and for the generator, $V_2A_2/(X - Y/2) + A_2^2R_2 + A_1^2F_2 + V_2A_2$. The author has made an extension to this method by adding two low-resistance shunts, r_1r_2, a millivoltmeter, *a*, and a voltmeter, *v*. By these instruments the differences, $A_1 - A_2$, and $V_1 - V_2$, have been measured as direct quantities. Greater accuracy can be obtained by measuring A_1 and *a* and using the value $A_1 - a$ instead of A_2, and measuring V_1 and *v* and using the value $V_1 - v$ instead of V_2. For instance, if $V_1 = 500$, $A_1 = 50$, $V_2 = 450$, $A_2 = 42$, $R_1 = R_2 = F_1 = F_2 = 0.5$ ohm, and the liability for error in reading the instruments is 1 per cent., then the possible error in the value of $X - Y$, when V_1, A_1, V_2, A_2 are the measured quantities, is 31.9 per cent.; whereas, it is 1.9 per cent., when V_1 *v* A_1 *a* are the measured quantities.—Lond. *Elec.*, September 18.

String Galvanometer.—EINTHOREN.—An abstract of a paper describing the instrument constructed by the author, of which it is stated that it appears likely to displace the capillary electrometer as an instrument for physiological research. The instrument consists essentially of a silvered quartz thread, which is stretched like a string in a strong magnetic field. When an electric current is passed through the thread, the latter is deflected perpendicularly to the direction of the magnetic lines of force, and the amount of the deflection can be measured by means of a microscope with an eye piece micrometer. The thread now used has a resistance of 10,000 ohms. If the tension is very feeble and the deflection requires ten or fifteen seconds to establish itself, the instrument can be made extremely sensitive, sufficient to measure a current of 10 to the 12th power amperes. But, as a rule, the tension used is such that the final position is reached in about one second or less. The motion is absolutely dead beat, and there is no perceptible disturbance from tremors nor any creeping of the zero as in the capillary electrometer. The author has applied the instrument to obtaining photographic "electro-cardiograms," showing the currents traversing the human body with every heart beat.—*Lond. Elec.*, September 18, from *Proc. Royal Acad. Sc.*, Amsterdam, August 27.

Demand Indicator for Three-Wire Installations.—DICK.—A short description of the method devised by him, with illustration of the instrument. There is a difficulty in measuring the maximum demand in three-wire installations, when two separate instruments are used, as the maximum values of the currents on the positive and the negative sides will probably not occur simultaneously. The new method consists in dividing the neutral wire, and inserting two equal resistances in the branches, across the ends of which the indicator strip is connected. The resistances are very low and the total drop is less than with two separate instruments. It can be shown that the reading on the demand indicator is always directly proportional to the sum of the positive and negative currents. This, of course, holds good for maximum values of these currents, which is what it is desired to measure. In addition to the gain in accuracy, considerable economy is effected by the employment of the three-wire instrument in place of two single indicators.—Lond. *Elec.*, September 11.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone Cables with Iron Wire Winding.—WALSOE.—The author believes that the Krarup method of winding several layers of thin iron wire closely around the telephone cables, for the purpose of compensation of the capacity, is more rational than Pupin's method. In the first place, the ohmic resistance is not increased and the self-induction is distributed evenly over the whole length of the conductor. Furthermore, the Pupin induction coils can only replace an evenly distributed induction for a predetermined number of oscillations. These oscillations vary, however, in the transmission of speech, between 100 and 1,000. The author states that he has made experiments with the Krarup method which disprove the objection raised against this system, namely, that it caused an increase of capacity. He found that the capacity is increased for direct currents, but that for alternating currents its value is considerably decreased and the more so, the higher the number of alternations. The author states that several cables laid recently between the Danish islands are provided with such iron wire winding. One of these cables contains four strands of seven copper wires each, of 1.35 mm. diameter. These wires are wound as closely as possible with an 0.3 mm. iron wire. Whether each individual wire or each bundle of wires is thus wound is not stated in the article. The author investigates mathematically the connection between the cross-section of the iron wires and the value of the self-induction and deduces a formula for the calculation of the latter. For the coefficient of self-induction of the above cable he calculates 0.002 henrys, while actual measurements gave 0.0025. He finds that the increase of the self-induction soon reaches its practical limit, and states that the powerful action of the capacity could hardly be compensated entirely by a mere increase of the self-induction. It remains, therefore, that a new means for the complete compensation of the capacity is still to be found.—*Elek. Zeit.*, September 10.

Block Signal System.—An illustrated article describing a block signal system for trolley railways. When the car enters a block, the trolley wheel passes a contact strip which actuates the signal system. In each signal box are two diamond-shaped targets. When the signals are employed on a single-track road between turnouts, the top target shows red when a car is approaching in the block ahead and the bottom target is not displayed. If there is a car in the block ahead traveling away from the signal the top target is not displayed and the bottom target shows white. Opposite each of these targets are lamps showing colors similar to those displayed by the targets. The targets are so wired, however, that they will operate whether the lamps light or not. When no car is in the block both targets are in a horizontal position and the lamps are all out. The same system can also be employed on double-track roads.—*St. R'y Jour.*, October 3.

REFERENCES.

Measured Telephone Service.—STROUD.—The first part of an illustrated serial. The author gives a description of the "nickel service" in Chicago and its rapid growth.—*Telephony*, September.

Regulations for Testing Electrical Machines.—A reprint of the Regulations for the rating and testing of electrical machines, proposed by the Association française des propriétaires d'appareils à vapeur and the Association des Industriels du Nord de la France.—*L'Eclairage Elec.*, August 29.

Forged Street Railway Paper.

According to a dispatch from Worcester, Mass., indorsements on paper of the Worcester & Southbridge Street Railway Company, representing nearly $1,000,000, are said to have been pronounced forgeries by handwriting experts. The road went into the hands of a receiver two months ago.

New Books.

THE METALLURGY OF ZINC AND CADMIUM. By Walter Renton Ingalls. New York: *The Engineering and Mining Journal.* 701 pages, 404 illustrations. Price, $6.00.

This book, while not appealing to the special field of electrical engineers, is so exhaustive and thorough a treatise on the subject that the reviewer believes that it deserves more than passing notice.

Zinc, of course, has had a tremendous influence on the development of electrical science. The discovery of the zinc primary cell gave the investigator a source of current which was fairly steady and efficient. Most of those who studied electricity before 1880 made more use of the Bunsen battery than the storage battery and generator. Now, of course, zinc is used even more largely in the form of sheet zinc for dry batteries, for enclosed fuses, and in cast zinc and rolled rods for negatives of several types of cells (e. g., the Leclanché and gravity). Sheet zinc is also used to seal up electrical instruments and other articles for shipment. Considering its low price, it is probable that sheet zinc will displace sheet brass and sheet copper for many purposes. Accordingly, Ingalls' "Metallurgy of Zinc" and his briefer book, "Production and Properties of Zinc," should be read by every electrical engineer who prides himself on being up-to-date in his professional knowledge.

For the metallurgist this book is of more than special interest. Not less than forty-five special forms of roasting furnaces are described. Chapter IV is in itself a treatise on mechanical roasters and Chapters VIII and IX on combustion of fuels and furnace designs. We take pleasure in stating that in our opinion this book is worthy of a place on the shelf of the metallurgist's library, besides "Howe's Steel," "Campbell's Iron," "Hofman's Lead," "Percy's Copper" and "Peter's Modern Copper Smelting."

STUDENTS' GUIDE TO SUBMARINE CABLE TESTING. By H. K. C. Fisher and J. C. H. Darby. Third Edition. New York: D. Van Nostrand Company. 230 pages, illustrated. Price, $2.50.

This book, in its latest edition, has been considerably enlarged and improved. It is divided into three parts. Part I deals with definitions of terms and the elements of regular cable testing. The descriptions are simple and clear. There is a good explanation of the universal shunt, although there are unfortunate misprints both in the illustration and in the text.

Part II is devoted to the localization of faults in cables, or to the tests of faulty cables. The treatment of the subject is excellent and is aided by a number of illustrative examples. Part III deals with the measurement of electrostatic capacity in cables and is a good compendium of the various methods in vogue.

The appendices contain useful tables, questions and answers or problems in the various sections of the book, as well as standard diagrams of signalling connections. The book terminates with a good index.

The work is specially recommended to all students of submarine cable testing and will be useful to all who are interested in that subject.

BOOKS RECEIVED.

ONDE HERTZIANE E TELEGRAFO SENZA FILI. By Oreste Murani Milan: Ulrico Hoepli. 341 pages, 170 illustrations. Price, 3.50 lire.

WHITTAKER'S ELECTRICAL ENGINEERS' POCKET BOOK. By Kenelm Edgcumbe. London: Whittaker & Company. 44 pages, 149 illustrations. Price, 3 shillings sixpence.

THE ENGINEERING AND ELECTRIC TRACTION POCKET BOOK. By Philip Dawson. New York: John Wiley & Sons. 1,411 pages. Price, $5.00.

DIE MONTAGE ELEKTRISCHER LICHT UND KRAFTANLAGEN. By H. Pohl. Hannover: Gebruder Janecke. 272 pages, 328 illustrations. Price, 4.40 marks.

DIE KRANKHEITEN ELEKTRISCHER MASCHINEN. By Ernst Schulz. Hannover: Gebruder Janecke. 50 pages, 42 illustrations. Price, 1.75 marks.

CONSTRUKTION UND PRUFUNG DER ELEKTRICITATSZAHLER. By A. Konigswerther. Hannover: Gebruder Janecke. 328 pages, 362 illustrations. Price, 9 marks.

ELEKTRISCHE APPARATE FÜR STARKSTROM. By George J. Erlacher. Hannover: Gebruder Janecke. 228 pages, 131 illustrations. Price, 8 marks.

THE PRACTICAL PHYSICS OF THE MODERN STEAM BOILER. By Frederick J. Rowan. New York: D. Van Nostrand Company. 638 pages, 314 illustrations. Price, $7.50.

The Co-Operative Telephone Company's System at Detroit, Mich.

Another chapter in the chequered telephone history of Detroit, Mich., and in independent development there, is begun by the opening of the exchange of the Co-operative Telephone Company's system in that city. Previous chapters have often been retold and are familiar to our readers, so it is not necessary to go over the story again. The starting up of this exchange would indicate that the "independent" spirit is still strong in the community, and that a large patronage is counted upon from the public, especially as there are 40,000 independent telephones and 600 independent exchanges and toll stations scattered through the State.

The company's franchise, embodying provisions which absolutely prevented any possible chance of its ever being absorbed by competitors, allows a charge for rentals of $48 for business and $24 for residence service, at which rate party line service may be given. The franchise also allows the use of the city's conduit system, pole lines

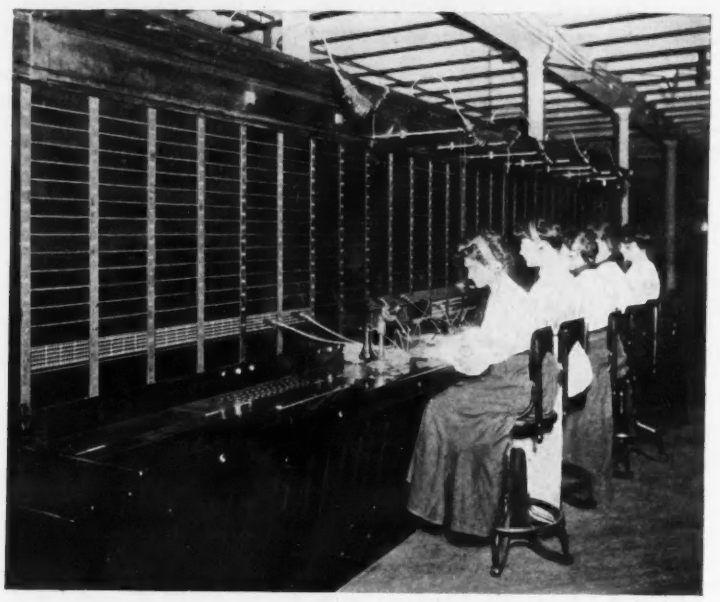


FIG. I.—12,000-LINE-CAPACITY SWITCHBOARD.

and public buildings upon a purely maintenance basis, which provision is of considerable advantage, the city owning its municipal lighting system covering the entire city with its conduit system and pole line.

Under the organization of the Co-operative Telephone Company each business subscriber also subscribes for at least one share of the stock of the company, par value $50. The conditions of these stock subscriptions and small stock holdings are such as to absolutely prevent their sale to the competitors.

In view, it is said, of the strong efforts being made to discourage investors in independent systems, it could not be hoped to establish a system covering the entire city upon this basis, and under these conditions, at once, so it was decided by the management of the co-operative company to start with a business men's exchange in the down-town district, to establish services with the more than 40,000 independent subscribers throughout the State, with the wholesale houses, hotels and other large business places, and to thoroughly demonstrate to the people the value of independent connections.

The company, under the leadership of Mr. C. M. Burton, president, one of Detroit's most prominent citizens, president of the Michigan Historical Society, and under the management of A. A. Cowles, also one of the local prominent business men, together with the support of J. C. Danziger, secretary; Max J. L. Towler, vice-president, and J. Ward Howland, treasurer, all local merchants of wide connections and with high reputation, soon had a sufficient number of business subscribers to warrant beginning work. The company had in view the establishing of an exchange with the most modern and practical system in use and one where the initial business men's exchange could be increased at any time without discarding the

original installation. They contracted with the International Telephone Manufacturing Company, of Chicago, for four sections with an ultimate capacity for 12,000 line lamp signal central energy multiple switchboard equipment, with long-distance central energy telephones embodying the many new features and improvements that have been evolved by the International Company.

The exchange is located in the Golden Block, 32 Michigan Avenue, which allows for extending space to make the necessary increase. Fig. 1 shows four sections of the original installation of switchboard. The board is constructed in sections with a capacity for installing the necessary multiple jacks for the ultimate equipment of 12,000 subscribers' lines. The sections are built of heavy architectural iron and are firmly braced to make them strong and rigid. The cabinet work is of heavily polished dark mahogany. The plug board and the pilot lamp panel back of the plug board are covered with mahogany-stained heavy belt leather ⅛ of an inch in thickness. The first position is provided with the necessary multiple jacks as an annex to the second position. The second and third positions are arranged for installing the necessary incoming trunk line equipments. The fourth position is equipped for twenty long-distance toll lines and arranged as extensions for a main toll board. The remainder of the board is equipped for regular city exchange lines.

The toll line signals are high-wound tubular drops, with drop shutters of the regular size. The local subscriber's line signals are a ⅓-cp lamp mounted in an opaque tube provided with a small opalescent jewel, set in a shouldered brass cap to allow it to be readily inserted into its socket or removed from the front of the board. The lamp signal jacks are arranged in banks of ten and are mounted in hard rubber strips provided with a well braced brass rail support. The banks of lamp jacks are so constructed that they can be readily installed or removed from the front of the board.

Alternating with the strips of lamp jacks and corresponding in number, are mounted the necessary answering jacks arranged in banks of ten, constructed with their springs firmly clamped in strips of hard rubber, and securely supported by a front piece of a heavy brass rail, provided on its front and back with strips of hard rubber perfectly insulating the ferules of the spring jacks from the frame. The multiple jacks are arranged in banks of twenty, mounted on ⅜-in. centers, with the construction of the banks the same as the answering jacks, making the banks very strong, rigid and durable.

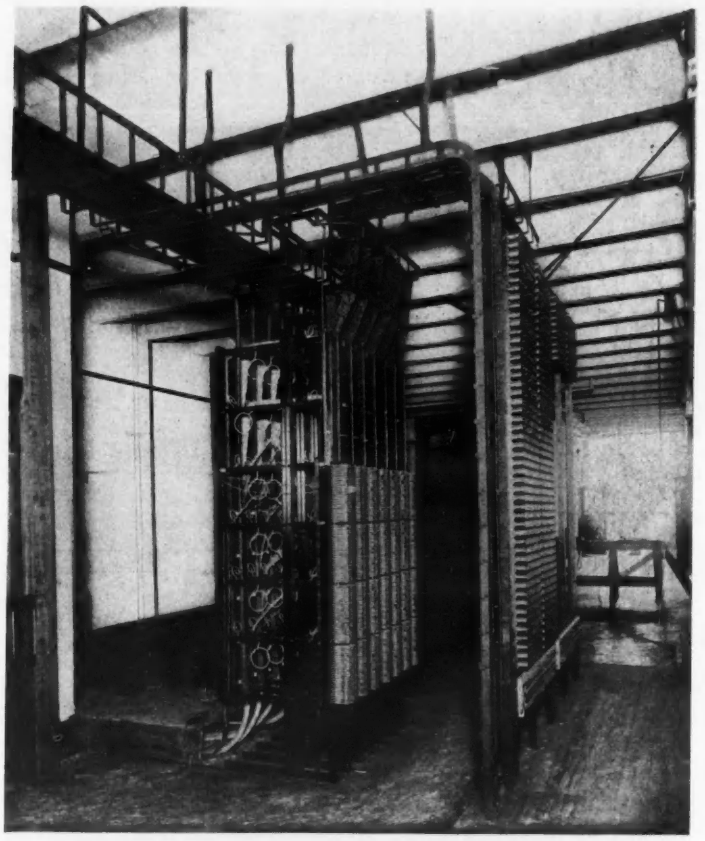


FIG. 2.—LIGHTNING ARRESTER AND DISTRIBUTING RACK AND RELAY.

The banks of multiple jacks are so constructed that they can be readily fastened or loosened from the front of the board. Their front heavy brass rail making them perfectly straight and rigid, allows the taking out a strip at any part of the position without disturbing those above the strip removed. The strong and solid construction of the banks and absence of contacts in the spring jacks, makes them practically indestructible and immune from incidental trouble.

Each operator's position is equipped with a long-distance International transmitter, mounted in a strong oxidized brass case. The

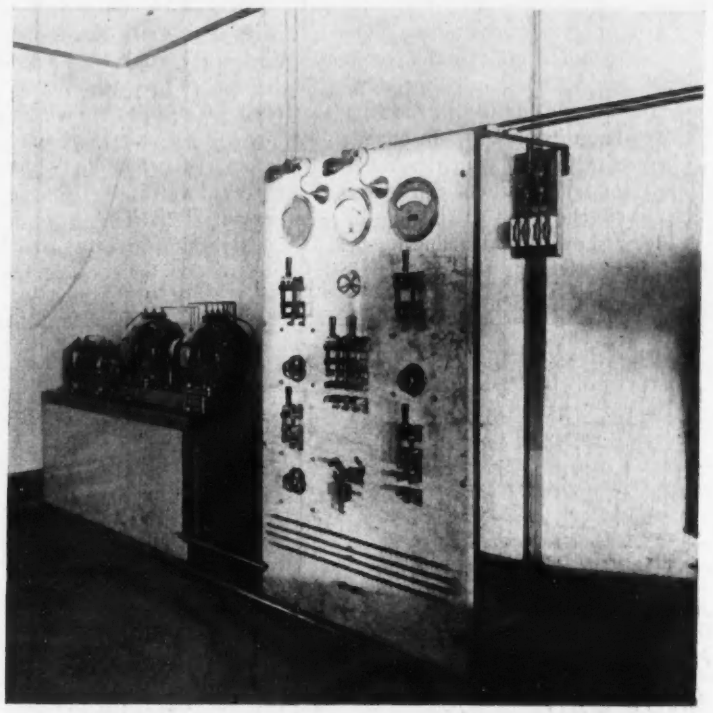


FIG. 3.—POWER PLANT FOR INITIAL INSTALLATION.

switchboard transmitters are adjusted to avoid taking up side tone as much as possible, to prevent subscribers hearing operators in adjoining positions, but transmitting clearly and distinctly conversation spoken directly into the mouthpiece in a low tone of voice. The transmitters are suspended on a pair of cords, supported by an adjustable extension arm. These arms are constructed of heavily nickel-plated brass on which are mounted oxidized hangings with pulleys. The cords are supplied with proper weights so that the transmitters may be lowered or heightened as required, and the arm is arranged to be extended or shortened, if necessary.

The operators' receivers are provided with a cord and plug and can be attached and detached at a cut-in jack in each position, mounted underneath the key shelf. The key shelves are constructed of five layers of the wood of which the board is constructed, glued together, the grain of the two outside and central layers running lengthwise and the grain of the other two layers running crosswise.

The ringing and listening keys are mounted on the bottom of the shelves with the lever passing through the shelf, supplied at the top with a nickel-plated brass sliding escutcheon to prevent dust entering. The sets of ringing springs and listening springs are mounted one above the other, firmly clamped in a hard rubber block. This arrangement allows the use of heavy and long springs to prevent breaking and the small and compact key enables mounting the required number in one line in each operator's position. The key springs are of German silver and provided with platinum contacts. The keys are constructed with the terminals of both the ringing and listening set at one end, enabling all connections to be made from one side with one key cable, and leaving the springs and contact points open for convenient inspection.

The supervisory clearing-out lamps, one for each cord, are mounted on the plug board between the plugs and the keys. The clearing-out signals consist of ⅓-cp lamps mounted in an opaque tube similar to the line signal and provided with an opalescent jewel set in a shouldered brass cap. This is supplied with an arched wire guard to prevent the breaking of the opal from impact of the plugs and also to provide the means for removing the lamps from the top of the board without the use of special tools. The supervisory lamp sockets or jacks are mounted individually on the bottom of the plug

board. The clearing-out lamp opal with guard is so constructed as to prevent the accumulation of dust.

The plugs are made small and compact to allow two or more being placed in adjoining multiple jacks, mounted on ⅜-in. centers. The sleeve of the plug is of black polished hard rubber and is mounted to allow its turning on the shank to avoid twisting the plug when inserting and kinking the cord, thus minimizing the cord trouble. The plug sleeve is fastened with a set collet screwed onto the shank from the front or tip end, to avoid using a set screw through the sleeve, and the possibility of breaking the shell.

Each operator's position equipped is provided with three pilot signals, one for indicating in connection with the subscriber's line signal, one to show in connection with the supervisory clearing-out signal, and one for use in the ringing circuit. The pilot signals are a ⅓-cp lamp mounted in an opaque tube, provided with a large brass cup receptacle into which is mounted the colored prism bull's eye. The pilot lamp sockets can be readily removed from the front of the board, the same as the line or clearing-out signals.

Fig. 2 shows the distributing board with lightning arrester board, and relay rack for the original installation of 600 lines. The line

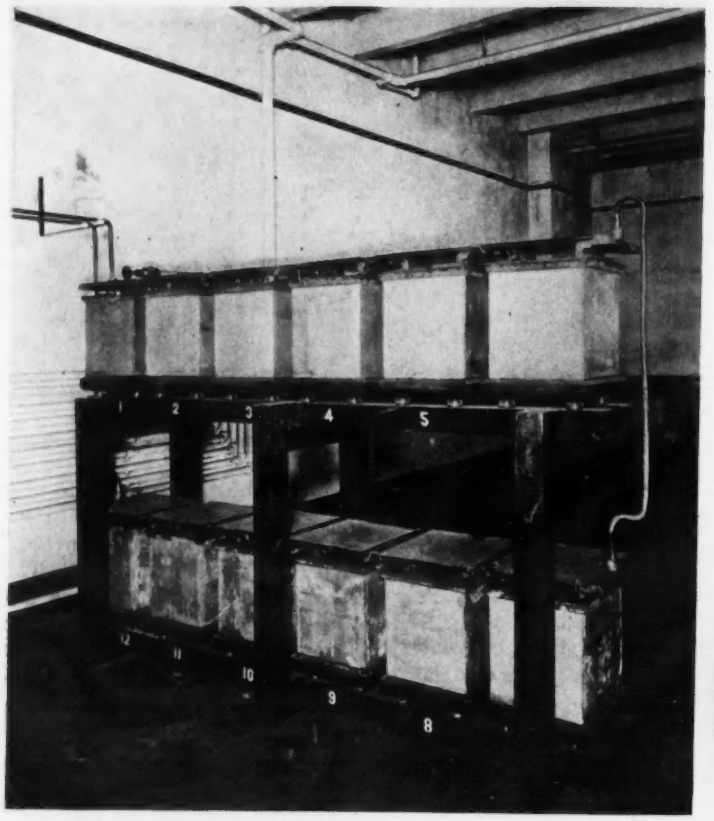


FIG. 4.—INITIAL INSTALLATION OF BATTERY PLANT.

side of the distributing board is arranged with immediate capacity for 800 pairs of cable. On the switchboard side of the distributing board are mounted 700 pairs of carbon lightning arresters with self-soldering heat coil protectors. The relay rack is divided in sections for 500 lines to the section. The rack is constructed of heavy architectural iron, well braced to make it strong and rigid. The relays are mounted in strips of ten. They are constructed with an iron-clad shell completely enclosing the winding-in iron when the armature is drawn up. The springs are constructed of the best grade of spring German silver and are of ample length to insure accuracy. All contacts are provided with platinum. The relays are so constructed and mounted as to be readily removed or inspected. In addition to the iron shell, the complete relay is individually enclosed with a heavy brass tube or cap, screwed onto a threaded base, avoiding rust or dust entering the working parts. At the bottom of the relay rack is mounted a heavy marble slab containing fuses for the leads to the relays in order to properly protect the coils.

The cables from the relay rack and the distributing board are run to the switchboard on a strong iron cable chute or rack. The distributing board and relay rack can be extended at any time up to the full ultimate capacity of the exchange.

Fig. 3 shows the power switchboard, charging machine, main and auxiliary ringing machines. The power board is built of a heavy marble slab, supported by an architectural iron rack of strong and rigid construction. It is provided with the necessary ammeters, voltmeter, voltmeter switch, circuit-breaker, starting boxes, field rheostat and the necessary double-pole copper blade knife switches for properly controlling the system. Fig. 4 shows one set of the battery plant, consisting of 12 cells of lead-lined tank Chloride storage batteries.

The telephones used in the system are of the well-known International long-distance type neatly and substantially constructed, efficient and durable. All distinct parts of the telephones as well as the switchboard equipment are made by machinery, directly from the crude material from modern designed compound dies and special tools, making all like parts absolutely uniform and renewable on the spot.

This exchange has recently been connected, through the toll lines of the Peninsular Telephone Company, of Detroit, with the other independent lines of the State, once more opening telephone communication with Detroit to the independent telephone subscribers in Michigan, as well as the independent systems throughout the other States.

Stanley Alternating Current Recording Wattmeter.

A new type of recording wattmeter for alternating-current circuits has been added to the list of the manufactures of the Stanley Instrument Company, of Great Barrington, Mass. This instrument, which is illustrated in the accompanying cuts, is known as the balance-

FIG. 1.—PERSPECTIVE VIEW OF WATTMETER.

thrust recording wattmeter, for which a number of important claims are made, as follows: There is no jewel wear from hammer or side thrust, and no "kicking" auxiliary friction device is used; the instrument has the highest effective torque, an improved spring support, the braking is not affected by temperature, magnetic short-circuits are impossible, and the instrument compensates for inductive lag; the method of sealing protects against any manner of tampering and the instrument is air, moisture, dust and insect tight.

It is well known that when a current is caused to flow through the field of a magnet a thrust is produced at right angles to the field and to the current flow. This tends to move the disc of a

meter bodily away from its normal position and forces the spindle against its bearings. In some meters this side thrust is fully as great, and in some cases greater, than the torque thrust, and of course increases the friction. In the Stanley meter this thrust is counterbalanced by closed-circuit copper rings placed over the side of the field or shunt pole nearest to the edge of the disc. By this means an opposing thrust is set up which can be proportioned to exactly counterbalance the side thrust. A second source of friction which is counterbalanced in the Stanley meter is that due to an unsymmetrical relation of the shunt or shunt and series system with reference to the disc. In this instrument the magnetizing forces are applied to the shunt system symmetrically, and being thus evenly distributed on each side of the disc, the pushing tendency of the magnetism is neutralized. A third source of friction in contact bearing meters is that due to the trembling or vibration of the disc or armature caused by the magnetic attraction and repulsion existing between the magnets and the moving parts. In the Stanley meter the disc is placed at the zero magnetic potential position and as a

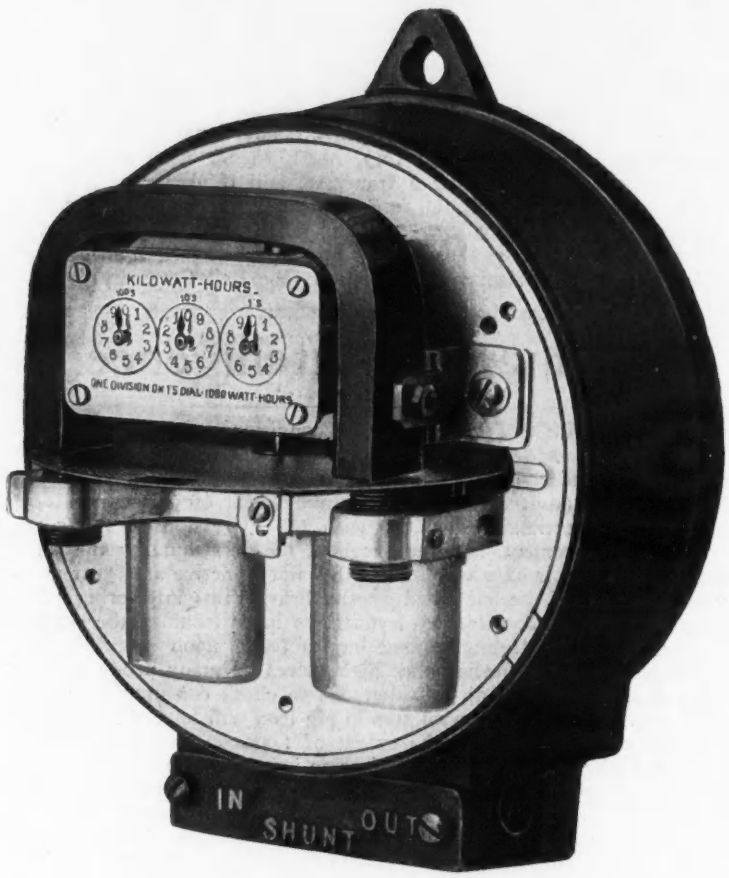


FIG. 2.—VIEW OF WATTMETER MECHANISM.

consequence all trembling or vibration of the disc is obviated. In this instrument also the magnetic balance existing prevents the lifting and filling of the disc, thus obviating a pounding action affecting the life of the mechanism and the accuracy of the instrument.

Owing to the balancing of the thrust in this meter its disc will not creep, moving only when energy is being used, and it will rotate and measure at extremely small loads. As a consequence there is no need of any auxiliary or kicking device. The air-gap or distance between the disc and brake magnets cannot be changed by variations of temperature, as the magnets are held rigidly in a permanent position, so that they cannot expand or contract. A feeder plate between the back and front of the meter constitutes a magnetic shield, upon the front of which plate is mounted the disc shaft and its bearings, the brake magnets, train gearing and other mechanisms. This shield acts as a complete protection to the brake system against the effects of short-circuits. The disc shaft when in place rests upon a finely polished, carefully-selected jewel mounted in a carrier supported on an accurately graduated spring. The entire arrangement of jewel, carrier and spring are immediately in sight and readily accessible for adjustment or replacement.

Seattle Municipal Power Plant.

A contract for supplying water wheels to the city of Seattle Municipal Lighting & Power Plant has been awarded the Pelton Water Wheel Company, of San Francisco. The main wheel units will be two in number, each direct-connected to a 1,200-kw, 400-r.p.m., 2,300-volt, 60-cycle, three-phase revolving field generator. The wheel units will operate under an effective head of about 550 ft. and will have a capacity sufficient to develop 50 per cent. overload in each generator. Combination needle and deflecting nozzles will be employed for regulating wheels, the needle portion to be hand-controlled, while Lombard governors will take care of the deflecting portion. The governors will be equipped with 125-volt motors to permit of central control of the main machines from the switchboard. Two 75-kw, 125-volt, compound-wound multipolar direct-current generators will furnish exciting current. Each of these machines will be direct-connected to a Pelton wheel running at 550 r.p.m.

A riveted steel pipe line of uniform diameter of 48 in. will lead the water a distance of about 1,080 ft. from the main penstock, the pipe varying in thickness from 3/8 in. to 11/16 in., terminating in a steel receiver, from which branch pipes will distribute the water to the various wheels. The transmission line into Seattle will be approximately 40 miles long, over two separate lines of three No. 1 copper wires, or equivalent aluminum wires. The current at Seattle will be stepped down to two-phase at 2,200 volts for city distribution for power purposes, incandescent lighting and arc and series incandescent street lighting by means of constant-current transformers.

Owing to the season being so far advanced, it is the intention to complete and get into operation one of the transmission lines, the other to be erected as soon thereafter as possible.

Street Railway Exhibits at Syracuse.

Quite a large number of concerns in the supply field were represented last week at the Syracuse convention of the New York State Street Railway Association. Some of them had exhibits.

THE CROUSE-HINDS ELECTRIC COMPANY, of Syracuse, N. Y., had a very neat exhibit, in the writing room of the Yates, of the various specialties manufactured by this company. It was along the lines of their recent fine exhibit at Saratoga. The booth was decorated by Norbitt specialties. The new arc headlight recently placed on the market was exhibited in operation. The Syracuse changeable headlight, junction boxes and heavy switches were also on exhibition. President H. B. Crouse was in charge, assisted by a staff of active employees.

THE GENERAL ELECTRIC COMPANY was represented by J. J. Mahony, H. Greer and A. B. Babson, of the New York office; W. Gibson Carey and J. G. Barry, of Schenectady; H. H. Crowell, of Syracuse, and J. C. Calisch, of Buffalo.

THE STANDARD UNDERGROUND CABLE COMPANY made a fine exhibit, including bare, weather-proof and rubber-covered wire, and aerial, underground and submarine cables. One of the company's large new plants has been devoted almost exclusively to the manufacture of trolley and weather-proof feed wire for railway use, and it is now engaged in turning out some of the largest orders for these materials given out of late. The company was represented by H. P. Kimball, of the New York sales office.

WESTINGHOUSE.—The interests of the Westinghouse Electric & Manufacturing Company were looked after by Paul T. Brady, S. B. Storer and J. D. Mickle, of the Syracuse office of the Westinghouse Company. The Westinghouse Traction Brake Company was represented at the convention by J. R. Ellicott, C. R. Ellicott and George E. Baker.

NATIONAL ELECTRIC COMPANY was represented by H. W. Ransom, J. T. Cunningham and R. Long. John A. Roebling's Sons Company was represented by M. R. Cockey and G. W. Swan. Pittsburg Reduction Company by S. R. Colby and W. R. Darby. American Steel & Wire Company by A. G. Greenberg and F. A. Keyes. The H. W. Johns-Manville Company by J. W. Perry. Ohio Brass Company by N. M. Garland. New Process Raw Hide Company by T. G. Meachem. Van Dorn-Elliott Electric Company by W. A. Dutton. ELECTRICAL WORLD AND ENGINEER by J. M. Wakeman.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The market continued depressed, the professional interests being bearish in sentiment while public buying of stocks was exceedingly restricted. An unfavorable impression was produced by the reduction of the Steel common dividend, and also by the developments in connection with the United States Shipbuilding scheme. The Steel shares, Amalgamated Copper and the traction stocks showed special weakness. Western Union rallied sharply at the close of the market on Wednesday on the news that the company had won an old suit against the American Bell Telephone Company. The stock closed on that day with an advance of 1¼ points. Brooklyn Rapid Transit fluctuated between 34¾, the highest, and 31⅝, the lowest, closing at 32¼, thus losing 1⅛ points net. Metropolitan Street Railway was also weak, ranging between 107½ and 102½, the closing price being 103, a net loss of 3½ points. General Electric is off 6 points, closing at 144 after having touched 140. The highest figure of the week was 149¾ and the sales aggregated 4,000 shares. Westinghouse common closed at the lowest figure of the year—134—this representing a net loss of 12 points for the week. The highest figure for this stock this year was 221. Preferred made a net gain of 6 points, closing at 172. Western Union closed at 82. American Telephone & Telegraph lost 3½ points, closing at 122¼. During the week it touched the lowest point of the year, viz.: 117¼. Following are the closing quotations of October 13:

NEW YORK.

	Oct. 6	Oct. 13		Oct. 6	Oct. 13
American Tel. & Cable	78¼	78¾	General Electric	147	140½
American Tel. & Tel.	127	..	Hudson River Tel.	..	..
American Dist. Tel.	25	24	Metropolitan St. Ry.	105	103
Brooklyn Rapid Transit	38⅛	31⅞	N. E. Elec. Veh. Trns.	..	..
Commercial Cable	..	145	N. Y. & N. J. Tel.	..	..
Electric Boat	15	18	Marconi Tel.	..	..
Electric Boat pfd.	40	42	Western Union Tel.	81⅛	81¾
Electric Lead Reduction	1¼	1¼	Westinghouse com.	142	131
Electric Vehicle	4	4	Westinghouse pfd.	165	161¼
Electric Vehicle pfd	6	5			

BOSTON.

	Oct. 6	Oct. 14		Oct. 6	Oct. 14
American Tel. & Tel	127⅛	120¼	Western Tel. & Tel. pfd.	*80	80
Cumberland Telephone	....	....	Mexican Telephone	1⅜	1⅛
Edison Elec. Illum.	231	230	New England Telephone	121⅛	*123
General Electric	145	142	Mass. Elec. Ry.	20	18
Western Tel. & Tel.	10	10	Mass. Elec. Ry. pfd.	77⅛	77⅛

PHILADELPHIA.

	Oct. 6	Oct. 14		Oct. 6	Oct. 14
American Railways	42	41	Phila. Traction	94	93⅛
Elec. Storage Battery	50	48	Phila. Electric	6¼	5⅞
Elec. Storage Battery pfd.	48	48	Phila. Rapid Trans.	12⅜	11¾
Elec. Co. of America	7⅝	7¼			

CHICAGO.

	Oct. 6	Oct. 14		Oct. 6	Oct. 14
Central Union Tel.	..	..	National Carbon pfd.	88	*89½
Chicago Edison	140	143	Metropolitan Elev. com.	18	17
Chicago City Ry.	170	170	Union Traction	4	4
Chicago Tel. Co	115	115	Union Traction pfd.	30	30
National Carbon	*20	19			

* Asked

BOSTON EDISON.—The annual meeting of the Edison Electric Illuminating Company, of Boston, is to be held October 13. The company closed its fiscal year June 30. Its report of operations as filed with the gas commissioners compares as follows:

	1903.	1902.
Income from sales of light and power	$2,663,733	$1,840,291
Expense of station	533,732	339,340
Expense of distribution	250,705	201,929
Expense of management	243,583	188,272
Expense of taxes and incidentals	702,435	516,058
Total expense	$1,730,456	$1,245,599
Net income	933,277	594,692
Other income	36,578	47,021
Total net	$969,855	$641,713
Accrued profits from purch. Cos.	.....	306,129
Total	$969,855	$947,842
Interest and miscel. charges	185,508	174,654
Balance	$784,347	$773,188
Dividends	804,667	727,345
Surplus	Def. $20,320	$45,843
Previous surplus	60,951	15,109
Total surplus	$40,631	$60,951

The 1902 figures include the operations of the Boston Electric Light Company but for five months, and the Suburban Electric Light Company for seven months.

CLAY CREDITORS.—A committee of seven bankers, of which Frederick B. Schenck, president of the Mercantile National Bank, New York, is chairman, representing the interests which are creditors in the bankruptcy proceedings of the various Penfield clay products companies, has sent out a circular looking to the consolidation of the creditor interests. When the receivership was sought, on account of notes to a number of Eastern and Western banks then becoming due, and for which Mr. Penfield, in his scheme of financiering, had apparently made no arrangement in the matter of payment, the creditor institutions agreed not to press their paper until such plan could be worked out as would enable all the demands to be met.

TELEPHONY IN CINCINNATI.—The Queen City Telephone Company has been incorporated in Cincinnati with a capital of $1,000,000, but this capital will eventually be increased to either $4,000,000 or $6,000,000. The company, which is closely identified with the independents, claiming to have connections as far east as Philadelphia, west to Kansas City, north to St. Paul and south to Galveston, will apply for a franchise, and if necessary will go before the Legislature this fall in order to secure authority to establish its exchanges. The new company when once established will cut the rates far below those which are now being charged by the City & Suburban Telegraph Association (the Bell Company).

Commercial Intelligence.

THE WEEK IN TRADE.—Trade conditions are still irregular, as reflected by reports to the mercantile agencies. There are, however, many underlying favorable conditions, first of which is the better tone of advices from the corn and wheat crops. Others are improving collections, coincident with the expansion of the corn and cotton movement, and the excellent business done by the railroads. Business is of a fair volume, but not so active as a year ago, partly because of the backward season, heavy rains interfering with crop movement and collections; vexatious labor troubles, the spread of a conservative feeling among buyers based upon stock market liquidation, and the feeling that high prices of many products will tend, if they have not already done so, to check consumption automatically. The growing weakness in pig iron will have the effect of shutting off production to the extent of 1,000,000 tons for the last quarter of the year and of ending foreign imports. Finished products of iron are taken in a fair way, and some railroads are entering the markets for rails and cars. Copper showed no improvement, and the market is still practically lifeless. In the absence of demand the official quotations remained unchanged and are nominally as follows: Lake, 13⅜; electrolytic, 13⅛, and casting stock, 12⅞. Railway earnings for September promise to show a gain of fully 10 per cent. over the same month a year ago. Business failures for the week ending October 8, according to *Bradstreet's*, numbered 197, against 153 the week previous, and 170 the corresponding week of last year.

MINING EQUIPMENT FOR GUANAJUATO.—Electricity will be largely employed in extensive operations on the Guanajuato River, Mexico. The working of the tailings will necessitate the purchase of large shovels to be electrically operated as well as various other mining equipment. E. Gybbon Spilsbury, of the Spilsbury Engineering Company, 45 Broadway, New York, has gone to Mexico regarding the undertaking and on his return, early next month, contracts will be awarded. The plant will have an initial capacity of 1,000 tons a day.

MOTORS FOR CAPE MAY SEWAGE WORK.—The Mackay Engineering Company, 149 Broadway, New York, has secured a contract for a 100-hp and a 50-hp motor for direct-connection to pumps built by R. D. Wood & Co., of Philadelphia. The equipment is to be used in connection with the city of Cape May, N. J., sewage work. The motors will be built by the Akron (Ohio) Electric Manufacturing Company.

ELECTRIC COAL CUTTING MACHINERY FOR N. S. W.—The Jeffrey Manufacturing Company, of Columbus, Ohio, has secured a contract for electric coal cutting machinery for installation in one of the principal collieries in New South Wales.

CANADIAN WESTINGHOUSE COMPANY, LIMITED, ORGANIZED.—At a meeting held at Hamilton, Ont., October 8, the Canadian Westinghouse Company, Limited, was organized with a capital of $2,500,000. Mr. Westinghouse was present, accompanied by Mr. H. H. Westinghouse, vice-president of the Westinghouse Air Brake Company, of Pittsburg, Pa.; Mr. John Caldwell, treasurer of the same company; Mr. Frank H. Taylor, vice-president of the Westinghouse Electric & Manufacturing Company, and Mr. George C. Smith, president of the Security Investment Company, all of the same city. They were met by Mr. Paul J. Myler, of Hamilton, who has been manager and secretary of the Westinghouse Manufacturing Company, Limited, which the new organization succeeds. The new company is a consolidation of all the Westinghouse interests in Canada, which heretofore have been conducted individually. It will take over all the property patents and other interests of the succeeded companies, including the sales organization and business of Ahearn & Soper, of Ottawa. The organization committee elected the following board of directors: Mr. George Westinghouse, of Pittsburg; C. F. Size, of Montreal; H. H. Westinghouse, George C. Smith, Frank H. Taylor, L. A. Osborne, all of Pittsburg; Thomas Ahearn, of Ottawa; Hon. J. M. Gibson, of Hamilton; W. Y. Soper, of Ottawa, and Paul J. Myler, of Hamilton. The executive committee as formed will consist of H. H. Westinghouse, F. H. Taylor, L. A. Osborne, George C. Smith and W. Y. Soper. The officers as elected are: George Westinghouse, President; H. H. Westinghouse, vice-president; F. H. Taylor, vice-president; Paul J. Myler, general manager and treasurer; John H. Kerr, secretary. The board when complete will consist of fifteen members, the remaining five to be named from the Canadians interested. Ground is to be broken for the new works in Hamilton within the next two weeks, and the erection of the buildings will follow as fast as possible. It is expected that at least a thousand employees will be serving the company within a year, as soon as the plant is completed. When it is considered that the Westinghouse Manufacturing Company alone have had sales in the Dominion amounting to about $2,000,000 annually, the importance of this addition to the Canadian industry cannot be overestimated.

MEXICAN TRACTION COMPANY.—The American capitalists interested in the Compania Mexicana de Traccion (the Mexican Traction Company) recently organized for constructing and operating an extensive system in Mexico City, met in New York last week for the purpose of increasing the financial resources of the enterprise, and determining as to what rails, cars and power equipment would be required. About 1,000 tons of 85-pound girder rails will be ordered right away. The company will also be in the market for twenty 40-ft. cars, which will be equipped with four motors of 56 hp each. The power house will have an initial capacity of 2,000 hp. Westinghouse equipment will be installed. The company has acquired what are known as the Moylan, Garcia & Requima concessions, which permit of the building and working of about 100 miles of road, about 50 in the city and 50 in the suburbs. The company has also assumed control over the Empresa del Circuito de Banos, a horse road two miles long, operating between Belvanera and Alberca, in the heart of the Mexican capital. It will be electrically converted. Construction will begin immediately. M. R. McAdoo, 15 Wall Street, New York, is president of the company. The other officers are Mexicans. The company is incorporated under the Mexican laws. There is an American advisory board of directors composed of Pittsburg capitalists. The directors are James B. Oliver, Julius Bieler, Reuben Miller, Sr., James H. Park and Frank B. Smith. Mr. Oliver is president and Mr. Bieler is treasurer. The chief engineer of the company is A. T. Montgomery, C. E., Mexico City. George C. Pierce, formerly of another road, has been appointed superintendent and electrical engineer of the new company. Construction work will be begun right away, and the system is expected to be in active operation inside of eighteen months.

ST. LOUIS FAIR FIRE PUMPS.—The authorities of the Louisiana Purchase Exposition are taking every precaution to prevent the recurrence at St. Louis of any such disastrous fire as that which destroyed the great cold storage building at the Chicago Exposition in 1893, and are making adequate provision for water supply by putting in the largest installation of fire pumps in the world. These pumps, which have been purchased from Henry R. Worthington, of New York City, comprise twelve 1,000-gallon standard underwriter fire pumps, each capable of supplying four fire streams, making it possible to have 48 fire streams in use at one time. The pumps are of the duplex, double-acting type, and are supplied with air and vacuum chambers of large capacity. The fittings are of composition metal throughout, and the piston and valve rods are of bronze. Every measure has been taken in designing these pumps to insure that they will start at a moment's notice at any time after having been idle for a long period. They are the pumps recommended by the Associated Factory Mutual Insurance Companies, and, in fact, formed the basis of the specifications for fire pumps adopted by the Associated Companies.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, of Chicago, reports that it has just shipped several carloads of central energy switchboard equipment to the Fort Worth Telephone Company, Fort Worth, Tex. The capacity of the exchange is 6,000 lines. It is thought that this is the first large switchboard intended for independent service where each cord circuit is equipped for four-party selective signaling service; the American Company's high and low-frequency selective apparatus having been adopted. In addition to the Fort Worth equipment, a 3,000-line capacity switchboard has been shipped to the Kewanee Telephone Company, Kewanee, Ill., this switchboard also being equipped complete with four-party selective keys.

TURBINE STEAMSHIPS.—Mr. William Denton, head of the firm of Swan, Hunter, Wigham & Richardson, one of the largest shipbuilding concerns in the world, states that in all probability the new Cunard liner which his firm is about to build will have turbine engines. The Cunard Company has appointed a committee of experts to study the question. The new liner, said Mr. Denton, will be larger than the *Deutschland*. She will be 785 ft. long, and will have a displacement of 37,500 tons. Mr. Denton is convinced that the turbine engines, in which he has the greatest faith, will prove an immense success in vessels of that type. The new liner will be built at Newcastle-on-Tyne.

THE EUREKA ELECTRIC COMPANY, of Chicago and Genoa, has just furnished one of its late outfits, comprising the new Bell style ring-down magneto switchboard, to the exchange at Fullerton, Neb. It now has a complete 200-line outfit and this will make one of the finest in the State of Nebraska. The Eureka Electric Company also has its apparatus installed at Wahoo, Neb., in one of the most successful independent exchanges. This company is also manufacturing a self-restoring drop switchboard as well as a central energy visual drop board, in regard to which it has issued a new catalogue and bulletins Nos. 26 and 27.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, Chicago, reports a decided increase in number of orders for the past month. It has recently placed on the market a new type mechanical self-restoring drop switchboard, which has met with such favor that a large number of orders were booked before the tools were completed for its manufacture. The first delivery of the board was made to D. S. Thomas, Paris, Mo., who purchased a complete exchange equipment, including telephones.

ENLARGEMENT OF N. Y. EDISON SUB-STATION.—The New York Edison Company has filed plans with the building bureau for a new four-story basement and mezzanine story electric power house to be built by it in West Twenty-seventh Street, between Broadway and Sixth Avenue, immediately in the rear of the present power house in West Twenty-sixth Street. The new building will be 44 ft. front and 96 ft. deep, and will cost $85,000.

THE JENNEY ELECTRIC MANUFACTURING COMPANY, of Indianapolis, has opened an office at Chicago, with Mr. A. J. Cline, formerly with the Milwaukee Electric Company, in charge. The company, which manufactures a complete line of direct-current motors and generators, will give special attention to machine tool and printing press equipments.

LIGHTING OUTFITS FOR MANHATTAN BATHS.—The Borough of Manhattan Public Baths are to be equipped with lighting outfits. The Buffalo Forge Company, 39-41 Cortlandt Street, has secured a contract calling for six 40-hp engines, which are to be direct connected to Crocker-Wheeler generators of 25 kw capacity each.

MOTORS FOR PRINTING TICKERS.—The Page Machine Company, 812-814 Greenwich Street, New York, has placed a contract with the Holtzer-Cabot Electric Company for 50 motors of special design, and of 1-20 hp capacity for operating the company's printing tickers in Philadelphia.

LIGHTING PLANT FOR CUBA.—The Mackay Engineering Company, 149 Broadway, has secured a contract through the American Trading Company for a small lighting equipment for Cuba. The outfit will be built by the Akron (Ohio) Electric Manufacturing Company.

LIGHTING EQUIPMENT FOR AUSTRALIA.—Mackenzie, Quarrier & Ferguson, 114 Liberty Street, has secured an order for a 90-hp, belted Harrisburg engine, to drive a 55-hp generator, for shipment to Sydney, Australia, for lighting purposes.

EQUIPMENT FOR MEXICO.—The Reeves Engine Company, Trenton, N. J., have secured a contract for a 400-hp engine for direct connection to a 200-kw generator of General Electric build, for a Mexican plant.

THE STANLEY ELECTRIC MANUFACTURING COMPANY, of Pittsfield, Mass., has sold a 2,000-kw revolving field generator to the Memphis Consolidated Gas & Electric Company, Memphis, Tenn.

General News.

THE TELEPHONE.

DEMOPOLIS, ALA.—The Demopolis Telephone Company's lines are being extended very rapidly; about 10 new telephones per month have been added. The switchboard is of Stromberg-Carlson make, and there are 160 subscribers.

OSCEOLA, ARK.—The Tristate Telephone Company, of Osceola, has been incorporated with a capital stock of $25,000. The incorporators are W. J. Driver, president; C. H. Gaylord, vice-president; William Pyles, secretary and treasurer; R. C. Rose, Charles S. Driver, Samuel Bowen, S. S. Semmer, J. H. Lovewell, J. L. Ward, J. W. Edrington, A. O. Burton and L. A. Morris.

SAN FRANCISCO, CAL.—The Yosemite Valley Commissioners, it is stated, will inaugurate a telephone system in the Yosemite Valley.

LOS ANGELES, CAL.—The Home Telephone Company is planning to extend its line from El Monte to Pomona, a distance of about twenty miles.

LOS ANGELES, CAL.—The Sunset Telephone & Telegraph Company has begun extensive repairs and remodeling in its systems at Santa Monica and Ocean Park.

DENVER, COLO.—The Pitkin Telephone Company has been incorporated with a capital stock of $10,000. The directors are Scott Dickenson, John Pinson, W. S. Henderson, D. C. Masson, W. Heckert, John Custed and Thomas Huxtable.

CAIRO, ILL.—The Central Union Telephone Company has sub-licensed the Thebes Home Telephone Company of Thebes. The latter place will be connected with Cairo.

BLOOMVILLE, ILL.—Mr. J. T. Carbin operates an exchange at this place and also one at Republic. The former has 125 subscribers and the latter 75, which will soon be increased to 100.

INDIANAPOLIS, IND.—The New Long Distance Telephone Company declared a dividend of one per cent., payable Oct. 15.

CONNERSVILLE, IND.—The Connersville Independent Telephone Company is putting in a new "central energy" system at a cost of $10,000.

INDIANAPOLIS, IND.—The Libertyville Mutual Telephone Company, of Libertyville, Vigo County, has filed articles of incorporation. The capital stock is $5,000. J. B. Baatman is president and Ira D. Andrews, secretary.

BURROWS, IND.—The Burrows Telephone Company filed articles of incorporation with the Secretary of State. The capital stock is $15,000. The company will build and operate a telephone system in Carroll and Cass counties with principal office and exchange in Burrows.

RICHMOND, IND.—The directors of the Richmond Home Telephone Company has declared a quarterly dividend of one per cent, payable Oct. 15. This dividend does not include the bond interest. P. J. Freeman resigned the office of president and A. C. Lindermoth was elected.

SULLIVAN, IND.—The Sullivan Telephone Company has been organized and incorporated with a capital stock of $50,000. The headquarters and exchange will be in Sullivan. The incorporators are W. W. Harbaugh, W. T. Melott, J. S. Bays, C. J. Sherman and G. R. Dutton.

WABASH, IND.—The Central Union Telephone Company has submitted the draft of an ordinance asking for the right to use the streets of this city for a period of twenty-five years. The company has been operating without a franchise and was ordered to remove the poles and wires. It is doubtful if the franchise will be granted.

CLAYTON, IND.—The Clayton Free Telephone Association has transferred its property to a company of five local men, of which E. J. Smith is president, and D. M. Reynolds, secretary. The new company will furnish switching service and keep up lines to the town limits. The association has been operating on the co-operative plan, and its business became so large that it was thought best to make the change. Party lines will continue as private property up to the town limits. There are 150 subscribers and the company expects to add several hundred more.

EVANSVILLE, IND.—The United States Court convened in this city Oct. 5, Judge Anderson presiding. The most important case on the docket is the injunction proceedings of the Cumberland Telephone Company against the city of Evansville. The decision of this case will practically decide the status of the Cumberland Telephone Company in this city—whether it has a right to remain in the city and to use the franchise under which it has done business in past years. The company has installed a new switchboard in a new exchange building and built new lines in the city, while the city has encouraged the organization of the Municipal Telephone Company to occupy the field exclusively.

SLOAN, IA.—The North Telephone Company has been formed with a capital stock of $5,000 to build rural lines.

DES MOINES, IA.—The Jasper County Telephone Company has increased its capital stock from $100,000 to $150,000.

BOONE, IA.—The Central Union Telephone Company, it is stated, proposes to erect a handsome exchange building in this city, if it cannot buy an existing building that is suitable for its purposes.

BOONE, IA.—The Jackson Telephone Company has been incorporated with a capital stock of $10,000. This business has been established for some time. The officers are W. A. Will, president; W. S. Crisswell, secretary, and Emmanuel Nelson, treasurer.

SHELBY, IA.—The Shelby Independent Telephone Company operates exchanges at Shelby with 190 subscribers and Minden with 150 subscribers. The company is installing an exchange at Neola with a capacity of 600 drops, and is operating about 80 miles of toll line. Its local rates are $2 per month for business, and $1 for residence. The rate for rural service is $18 per year. The company is continually building lines, and expects to cover all the section of the country to the Missouri River west of Avoca. The officers of the company are: President, C. R. Benedict; vice-president, D. C. Cooper; secretary, N. Jasper Jones; treasurer, G. A. Cassidy.

DURANT, I. T.—The Chickasaw-Choctaw Telephone Company of this city has purchased the line of the Western Telephone Company between Durant and Mead, and will extend this line to Kinlock, Fort Washita and Madill. The company is erecting two new wires between Durant and Denison.

WELLINGTON, KAN.—The Western Union Telegraph Company has run a special wire from Ponca City to Blackwell, O. T., to connect with Kansas City, Chicago and New York, to be used exclusively for the markets from the East; also a special wire from Topeka to Wellington, Kan. and another to Arkansas City, to be used for railway service.

DANFORTH, ME.—The Danforth Telephone Company has been organized with a capital stock of $10,000, of which $2,000 has been paid in. The officers are: President, Veazie A. Price, of Weston; treasurer, Martin L. Porter, of Danforth.

SOUTH FRAMINGHAM, MASS.—The New England Telephone & Telegraph Company is putting in an underground service in this town.

SALTILLO, MEX.—It is stated that another telephone line is being constructed at Saltillo.

ST. PETER, MINN.—The Nicolett County Telephone Company will make extensive additions to its system.

BUCKLIN, MO.—The Bucklin Telephone Exchange has been sold by its former owner and manager to Mr. George Linberry.

PARNELL, MO.—The Parnell Mutual Telephone Company and the North Mutual Telephone Company have been consolidated and will be operated under one management.

HALE, MO.—The Hale Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are George R. Vaughan, J. R. Heryford, W. W. Deardoff and others.

NAPOLEON, MO.—The Napoleon Telephone Company has been incorporated with a capital stock of $5000. The incorporators are J. M. Hutchins, H. F. Ellers, P. D. Williams, Adolph Bettien and J. A. Woestemeyer.

HANNIBAL, MO.—The directors of the Bluff City Telephone Company have elected officers as follows: President, J. F. Davidson; vice-president, C. E. Brown; secretary and manager, H. C. Conger; treasurer, James P. Hinton.

MISSOULA, MONT.—The Rocky Mountain Bell Company contemplates extending its lines to Spokane by way of Sand Point, Ida.

FREMONT, NEB.—A trust mortgage to Mr. S. S. Sidner to secure an issue of $20,000 of bonds has been filed by the Fremont Telephone Company. A portion of these will be sold to meet outstanding indebtedness.

SPRINGFIELD, N. J.—The Central New Jersey Telephone Company has petitioned the Springfield township committee for a telephone franchise. The home office of the company is at Trenton, N. J.

MANLIUS, N. Y.—The Manlius Telephone Company, with 30 subscribers, has just started a co-operative local system.

NAPLES, N. Y.—Some rural party lines are projected by the Naples Telephone Exchange which has at present about 100 subscribers.

WAYNE, N. Y.—The Barrington-Wayne Telephone Company, with a capital stock of $2500 has been incorporated by Olney Welker, Elmer E. Miles, Dundee, N. Y., and Quincy A. Earnest, Wayne, N. Y.

ONTARIO, N. Y.—The Wayne-Monroe Telephone Company, of Ontario, has been incorporated; capital, $30,000. Directors: J. A. Driscoll, Rochester; L. T. Yeomans, Walworth, and J. Selden Brandt, Ontario.

MORGANVILLE, N. Y.—There are 28 subscribers to the Stafford Telephone Company which expects to double the number within a year. Through the Inter Ocean Telephone Company long distance connection is secured.

MIDDLETOWN, N. Y.—A Stromberg-Carlson central energy visual signal multiple board with 600 drops, ultimate capacity 1,000 drops, is being installed by the Orange County Telephone Company. There have been 86 telephones added since January, the company having now 641 subscribers. It expects a large addition to the number when the new board is in working order.

JAMESTOWN, N. Y.—The Ashville & Panama Telephone & Telegraph Company, which was organized recently, has 185 subscribers, its switchboard capacity being 50 drops. The company has 41 miles of toll line and intends to build 10 to 15 miles of local lines this fall. The system throughout is equipped with Stromberg-Carlson apparatus. The rates for service are $9 and $12 per annum, payable in advance. Mr. Alton H. Appleby is secretary and treasurer.

COINJOCK, N. C.—A charter has been granted to the Currituck Telephone Company, of Coinjock, with a capital of $2,500. E. R. Johnson is interested. The company will operate in four counties.

WILLIAMSTON, N. C.—The Williamston Telephone Company claims to have more subscribers for the size of town than any other place in its part of the country. There are 88 miles of toll line and 90 subscribers.

HOPE, N. D.—A line from Page to Casselton, N. D., is under consideration by the Union Telephone Company, which serves at present 165 subscribers, and has 50 farm stations. An "American" 130-drop switchboard is in operation.

HILLSBORO, N. D.—The Hillsboro, Duane, Caledonia & Shelby Telephone Company has 225 subscribers (all using farmers' lines), with Standard Telephone Manufacturing Company's apparatus. The charge is $15 per annum in advance.

ROCK HILL, S. C.—The Southern Bell Telephone Company will build a long distance line between Yorkville and Rock Hill.

COLUMBUS, OHIO.—The Citizens' Telephone Company, of this city, is preparing to install a new automatic switchboard.

ALBANY, OHIO.—The Albany & Vales Mills Telephone Company has 100 subscribers and 100 miles of toll line. North apparatus is used.

LEXINGTON, OHIO.—A North 80-drop switchboard is used by the Mansfield Telephone Company for its 100 subscribers, who pay $1.25 a month.

BURTON, OHIO.—The Burton Telephone Company employs Kellogg apparatus. It has 225 subscribers and 75 miles of toll line. The rate is $12 per annum.

BELLEFONTAINE, OHIO.—The United Telephone Company contemplates increasing its plant. It numbers at present 750 subscribers, and has 450 miles of toll line.

ASHLAND, OHIO.—Kellogg apparatus is in operation at the exchange of the Star Telephone Company, which has a subscription list of 1,010. The company owns 350 miles of toll line.

GREENFIELD, OHIO.—The Greenfield Home Telephone Company has been organized, with $30,000 capital, by D. O. Miller, Stanley Pike, Fay Baldwin and others. It will install a local exchange.

BROOKVILLE, OHIO.—Two years ago the Brookville Telephone Company was started; it has now 160 subscribers, 15 miles of toll line and reports a good outlook. Swedish-American telephones are used.

ADA, OHIO.—The Ada Telephone Exchange Company operates an "American" 420-drop switchboard and has 510 subscribers. The charges for service are $2 for business and $1 for residence, per month.

FAIRVIEW, OHIO.—The Union Telephone Company has doubled the number of its subscribers in the last year and expects to add about 30 or 40 more next year. Kellogg apparatus is used. The rate is $12 a year.

TOLEDO, OHIO.—The Toledo Home Telephone Company has announced a slight advance in rates to take effect Oct. 15. The original rates were based on an exchange of 3000 lines, but now the company has over 7000 subscribers.

COVINGTON, OHIO.—Farmers' lines will be erected in all directions by the Covington Home Telephone Company. The exchange at Covington, having 350 subscribers, was rebuilt in 1902 and has gained 40 per cent. in the past year.

HURON, OHIO.—New telephones are being added every day by the Huron Telephone Company and several new country lines are under consideration. The 125 subscribers pay from $1 to $2.50 per month. Kellogg apparatus is installed.

COSHOCTON, OHIO.—The Citizens', Farmers' & Merchants' Telephone Company has had a very rapid growth, numbering now 1,500 subscribers. Five miles of cable are soon to be added. Kellogg, Viaduct and North instruments are employed.

CONNEAUT, OHIO.—Mr. Henry H. Hart, vice-president, reports a normal increase in the business of the Conneaut Telephone Company numbering at present 670 subscribers, who pay a rental of $1, $1.50 and $2. American Electric apparatus is installed.

ARLINGTON, OHIO.—Mr. Oscar Wise, general manager, People's Telephone Company, informs us that his company has added 75 subscribers in the past year, numbering at present 175. It expects to have 300 within a year. "American" apparatus is used.

HICKSVILLE, OHIO.—The Hicksville Telephone Company has secured 100 new subscribers in five months, the total number at present being 355. It operates 38 miles of toll line. American Electric apparatus is used. Mr. William Purdy is the secretary.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company announces that its new Kellogg central energy board will be in service about January 1. The new board will take care of 8000 lines. The change will not affect the several branch exchanges of the company.

KENT, OHIO.—The Portage County Telephone Company has 558 subscribers in Kent and about 1,700 in the county. The company plans to build 50 more miles of toll line. The rates charges are $18 and $24 on the selective system. North instruments are used.

CIRCLEVILLE, OHIO.—An exchange at Laurelville, Ohio, has lately been opened by the Citizens' Telephone Company, which has also built a line to Stoutsville, a point never reached before by the independents. The system has 925 patrons and 43 miles of toll line.

BELLEVUE, OHIO.—The addition of some farmers' lines is planned by the Bellevue Telephone Company, which has 475 subscribers, 50 of which have been added during the past year. The charges are $1.25 and $2 per month. A 600-drop "American" switchboard is in operation.

LIMA, OHIO.—The Lima Telephone & Telegraph Company has just completed a 600-pair-cable extension and connected up 400 additional subscribers, making the present number 1,500. The rates are $30 for business, $18 residence for a single line and $15 on a four-party line.

BRYAN, OHIO.—The Edon exchange of the Williams County Toll Line Company has been sold to the Edon Home Telephone Company, recently organized, with E. L. Palmer, of Edon, president, and E. E. Newman, Edon, secretary. The new company will improve the exchange.

GREENFIELD, OHIO.—New incorporation papers are now being taken out by the Greenfield Mutual Telephone Company for an increase of capital stock to $30,000. It intends to install cables and a new switchboard shortly. There are 435 patrons who pay a rental of $12 and $18 per annum.

ELMORE, OHIO.—Seven exchanges and 23 toll stations are in operation by the new Ottawa County Telephone Company, the entire system numbering 1,200 subscribers. There are 200 miles of toll line. An exchange of fifty telephones is projected for Curtice. Mr. J. G. Steinkamp is general manager.

BETHANY, OHIO.—The Bethany & Hughes Telephone Company was bought by the Hamilton Home Telephone Company, which will change the system, with 130 subscribers, from grounded to full metallic and will use all new instruments. It is purposed to build several rural lines this fall.

CAREY, OHIO.—The Carey Electric Company operates an American "Express" switchboard of 300-drops capacity and uses Kellogg and Hipwell telephones for the 275 subscribers. Ninety telephones have been added since January and the company is figuring on increasing the number of subscribers to 350 by January, 1904.

BRYAN, OHIO.—Manager U. G. Townsend, of the Bryan Telephone Company, informs us that the company has one telephone to every seven and one-half persons. The system has at present 435 subscribers, and the addition of 300 farmers' telephones of branch exchanges is under consideration. The Bryan exchange uses "American" apparatus.

FOSTORIA, OHIO.—The Citizens' Telephone & Message Company now has 887 subscribers and there are still 140 unfilled contracts on hand. The exchange is taxed to its utmost capacity and it is the plan of the company to increase the plant 50 per cent. American Electric apparatus is used. The rates charged are $24 and $12 for business and $18 for residence.

AKRON, OHIO.—Since 1901 the growth of the Akron People's Telephone Company, which operates in Summit County, has been almost beyond its ability to take care of. There are 3,548 subscribers at Akron, 1,200 at Barberton, 500 at Cuyahoga Falls, 400 at Hudson and 100 at Talmudy. Stromberg-Carlson telephones are used. The rates are from $12 to $36 per annum, according to the location of the telephone.

CRESTLINE, OHIO.—The Crestline Local Telephone Company has recently installed a new switchboard and cable, increasing the capacity of the exchange to 500. Heretofore it has been unable to care for new subscribers. Country lines projected will reach thickly settled regions, and the outlook is splendid, we are informed by President Jacob Babst. A 400-drop Stromberg-Carlson switchboard is used and North telephones.

COLUMBUS, OHIO.—Judge Dillon, of the Franklin County Court, holds that a telephone number is an asset. A Columbus grocer recently sold his store and ordered his telephone with the old number removed to his home. The purchaser of the store claimed that the telephone as well as the number by which it was known was part of the assets of the store and went with the purchase. The court sustained this view.

BATAVIA, OHIO.—Eleven exchanges in Clermont County are operated by the Citizens' Telephone Company, which is extending its lines to Cincinnati and will be able to give service as soon as it can arrange to get through the towns of Madisonville and Norwood. The Batavia exchange has 115 patrons, who pay $2 for business and $1 per month for residence service. The Citizens' Company has recently built 20 miles of toll and farmers' party lines.

KENTON, OHIO.—A gain of 215 subscribers for the year 1902 and 60 so far this year is the record of the Kenton Telephone Company, which has at present 780 subscribers. Mr. C. E. Nicholas, manager, writes: "Our farm telephones are increasing in number so rapidly that we will have to put them on a board by themselves and then add a selective system to them, but we want a selector that will let us use our present telephones and be full metallic and not use a ground or third wire."

CLEVELAND, OHIO.—President Dickson, of the Federal Telephone Company, denies that the Columbiana County Telephone Company is experiencing any great difficulty in increasing its rates in Columbiana County. The company gave a very low rate and allowed free toll service throughout the country. Recently it increased its rates and established a charge for toll service, with the result that some of the subscribers complained. President Dickson claims that the company will not lose more than 100 subscribers and that double this number can be acquired.

DAYTON, OHIO.—The Automatic Electric Company's system is in operation by the Home Telephone Company. Subscribers to the number of 1,400 are securing service and from 15 to 40 additions are being made daily. The charges are $40 for business and $28 for residences. We are informed that the automatic switches and telephones are giving excellent satisfaction and meeting with public approval and endorsement. It is the expectation to have the entire city covered by lines within two months. The Dayton exchange is stated to be the largest all-cable plant in the country. The officers of the Home Telephone Company are Mr. John T. Barlow, president; Mr. H. C. Kiefarber, vice-president; Mr. J. C. Reber, secretary and treasurer; Mr. W. C. Prickett, general manager; Mr. R. D. Funkhouser, cashier.

CADIZ, OHIO.—The Harrison County Telephone Company began business two years ago with 100 subscribers and since then has built 50 miles of toll line, put in an exchange at Jewett, and finished one in Scio last spring with 125 subscribers. It recently finished a copper metallic circuit from Scio to Canotton and Bowerstown, and is now making arrangements to build from Bowerstown to Plum Run, where it can connect with the Tuscarawas County Telephone Company. It now has under construction an exchange at Bowerstown. The United States Telephone Company has ordered material to build from Cadiz to Ulrichsville, which will connect the Harrison Company with all important towns and cities. Stromberg-Carlson apparatus is used. Cadiz has 210, Scio 140 and Jewett 50 subscribers. The charges are $24 for business, $12 for residence service.

FREDERICK, OKLA.—The Southwestern Telephone Company has been incorporated with a capital stock of $15,000. J. T. McClannahan is one of the directors.

PRAGUE, OKLA.—The Prague Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are J. B. Charles, of Stroud; H. Josey, of Prague; E. L. Conklin, of Sac and Fox Agency; Roy Hoffman, of Chandler.

PITTSBURG, PA.—The Northern Lackawanna Telephone Company has been incorporated with a capital stock of $5,000. M. D. Potter and W. C. Smith are among the directors.

BIRDSBORO, PA.—The Conestoga Telephone Company proposes to extend its line from Joanna to Birdsboro, a distance of ten miles, to connect with one of the long distance telephone companies.

DELMONT, S. D.—T. A. Pieplow has been granted a franchise for a telephone exchange in this place.

WATERTOWN, S. D.—The Dakota Central Telephone Company contemplates building a new exchange here, and some conduit work is projected.

DEADWOOD, S. D.—The City Council has granted the Nebraska Telephone Company a franchise giving the right to erect its poles and wires and to lay subways throughout the principal streets. A similar ordinance was passed by the City of Lead several months ago. It is stated that the company will make improvements in Deadwood to the extent of about $30,000.

NASHVILLE, TENN.—The Lauderdale Telephone Company, of Lauderdale County, has been granted a franchise. It is proposed to build and operate a line from Ripley to Durhamville and Arpa. The capital stock of the company is $1,500, and the incorporators are T. A. Anthony, W. G. L. Rice, L. C. Moorer, F. L. Spright, J. A. Holmes, E. R. Anthony and A. S. Anthony.

CORSICANA, TEX.—The Corsicana Telephone Company has just completed the construction of a telephone toll line from this city to Ennis, Tex.

SULPHUR SPRINGS, TEX.—The Northeast Texas Telephone Company, of Sulphur Springs, has been incorporated with a capital stock of $50,000. The incorporators are R. C. Hawley, James F. Quinn, Luther A. McLemore and John D. Williams, of Sulphur Springs, and J. J. Ellis, of Pittsburg, Tex.

OGDEN, UTAH.—The Independent Home Telephone Company, which recently received a franchise to operate in this city, has commenced work on the erection of a building.

MARTINSVILLE, VA.—The Henry County Telephone Company, of Martinsville has been incorporated with a capital stock of $800 to $5000. W. O. Minter is president.

RICHMOND, VA.—The Mendota-Benhams Independent Telephone Company has been incorporated with a capital stock of $2500 to $5000 by J. C. Pruner, W. W. Sproles, J. S. Fleenor and others.

RICHMOND, VA.—The Albemarle Mutual Telephone Company has been granted permission to change its corporate name to Farmers' Mutual Telephone Company. Mr. T. E. Powell is president, and Mr. C. A. Miller, secretary.

RICHMOND, VA.—The Central Telephone Company, of Charlotte Courthouse, has amended its charter so as to permit it to increase its capital stock to a maximum of $20,000. W. H. Smith is president and W. G. Williams, secretary.

SPOKANE, WASH.—The Pacific States Telephone & Telegraph Company plans the extension of its underground cables so that there will be direct communication between this city and Seattle. Heretofore connection had to be made by way of Portland, Ore. That line is one of the longest in the Northwest. The Rocky Mountain Bell Telephone Company already has material ready for the extension of its system from Sandpoint, Idaho, to Newport, Wash., where it will connect with the lines from this city. The strike of the telephone girls here has not yet been settled, but the girls are still confident of going back to their old employment.

RIO, WIS.—The People's Telephone Company, of this place, is actively developing rural service. It now has 700 subscribers, 100 of which are of recent acquisition. Its switchboard capacity is 300 drops Kellogg and Peerless Mfg. Company apparatus being used. Mr. J. L. Farrington is president of the company.

ELECTRIC LIGHT AND POWER.

SANTA ANA, CAL.—The citizens have voted to issue $60,000 bonds for an electric light plant.

MILLEDGEVILLE, ILL.—The question of constructing an electric light plant is under consideration here.

TERRE HAUTE, IND.—It is reported that the Terre Haute Electric Company will expend about $200,000 in new machinery and other improvements.

EVANSVILLE, IND.—W. B. McDonald has succeeded George Whysall as general manager of the Evansville Electric Light Company and has assumed his duties.

NEW CASTLE, IND.—The New Castle Light, Heat & Power Company has authorized the issue of $15,000 bonds for improvements. L. F. Wayman is secretary.

HAMMOND, IND.—The Hammond Illuminating Company has filed with the Secretary of State a certificate increasing its capital stock from $350,000 to $2,000,000. The company is organized to operate a lighting plant and heating system for Hammond, East Chicago and Whiting.

GREEN CASTLE, IND.—The two electric companies of this city have been merged by the sale of the plant of the Green Castle Electric Light Company to the Putnam Electric Company. The former company until the last few months had the contract for the city lighting. The Putnam Company organized and secured the contract for the city lighting which is the cause of the sale.

ELKHART, IND.—The Elkhart Power Company has been organized with Walter Brown, of Elkhart, president, and Vernon W. Van Fleet, of Elkhart, secretary. Work will begin immediately upon the erection of a power house; 12,000-hp will be installed this fall and more power will be added as soon as new dam can be completed, which will probably be early next year. It is the intention of the company to construct a 16-foot dam in St. Joseph River below the present dam.

EMPORIA, KAN.—Mayor John Martin is planning to expend $10,000 in extending the electric light system.

COFFEYVILLE, KAN.—A petition is being circulated asking the Mayor and City Council to call an election to vote on issuing $15,000 bonds for enlarging the electric plant.

OTTAWA, KAN.—Plans are being made for the construction of a new dam across the Marais des Cygnes River at this point and the installation of a plant to develop electricity from water power. The city will be asked to aid in the construction of the dam.

MORGANTOWN, KY.—J. O. Carson writes that it is proposed to construct water works and an electric light plant and bids will soon be asked.

NEW ORLEANS, LA.—The New Orleans Lighting Company will construct a new sub-station on Broad and Esplanade Streets.

HOLYOKE, MASS.—For the purpose of extending the electric light system the Board of Aldermen has authorized the city treasurer to negotiate a bond issue for $36,000.

GLENWOOD, MINN.—The village council has granted the recently incorporated Glenwood Mill & Electric Light Company a 15-year lighting franchise. The ordinance contains a provision that the village may purchase the plant at any time after five years.

DULUTH, MINN.—It is stated final surveys and engineering work of the Great Northern Power Company to determine most feasible plans for development of St. Louis River and for installation and transmission of electric power to Duluth and Superior and to the Missabe and Vermilion iron ranges have been completed. Manufacturers of hydraulic and electric equipment will now be asked for final designs and bids for water wheels and generators required for first installation of 30,000-hp.

ABERDEEN, MISS.—The Aberdeen electric light plant and franchise have been sold and transferred by J. F. Enderlin to E. M. and J. K. Jones. The entire system will probably be overhauled and repaired.

COLUMBIA, MO.—F. P. Spaulding has prepared estimates for water works and an electric light plant, to cost about $150,000.

OMAHA, NEB.—Some of the local ward improvement clubs are agitating the question of a municipal electric lighting plant though it is not probable that such a plant will be established in the near future.

ST. PAUL, NEB.—The City Council has granted a 25-year franchise to the Loup Valley Electric Company for the installation of an electric light system. The company includes J. E. and H. E. Crawford, of New Castle, Pa.

WASHINGTON, N. J.—W. M. Ostrander, Philadelphia, Pa., reports the sale by him of the Washington electric light plant to Mr. Harry Reed, of New York City. The Washington Company has a capital of $50,000. Mr. Reed expects to make Washington his home and give the property his personal attention. Mr. Ostrander also sold recently the plants at Hollidaysburg, Pa., and Hempstead, N. Y.

COOPERSTOWN, N. D.—J. S. Webster, of Minneapolis, Minn., contemplates installing an electric light plant here.

COLUMBUS, OHIO.—The Infirmary Directors are considering the advisability of establishing an electric light plant.

GREENFIELD, OHIO.—W. L. Day, of Bettsville, is considering the establishment of an electric light plant at Greenfield.

SCRANTON, PA.—Bids are wanted Oct. 16 for installing electrical equipment in the Almshouse at Hillside Home near Clarks Summit. Edw. H. Davis, Connell Building, is the architect.

SEVEN VALLEY, PA.—The Council of the borough of Seven Valley, a town of 500 inhabitants in this county, is considering the project of lighting the town by electricity. Spurgeon Heathecote, proprietor of the woolen mills at Glen Rock, Pa., is endeavoring to secure the franchise for supplying the town with light. Mr. Heathecote has purchased an old mill property at Seven Valley in which he will establish a woolen mill and also an electric light plant, if he secures the franchise. He is endeavoring to interest the proprietors of factories in the town with the view to supplying the plants with motive power.

GREENVILLE, S. C.—The Southern Water Power Company, of Greenville, is to develop about 40,000-hp in various places in upper South Carolina.

CLINTON, S. C.—There is considerable talk in the town of installing an electric light plant and water works, and a company has been interested.

SPOKANE, WASH.—It is reported that the Spokane Light & Power Company will develop water-power on Spokane River.

NEWPORT, WASH.—Alex. M. Winston and J. C. Odell, both of Spokane, have applied for a franchise for an electric light plant for Newport.

SPRING VALLEY, WIS.—H. C. Hullinter, of Berlin, has secured a franchise for an electric light plant.

JESUS MARIA, MEX.—A large electric generating plant is to be established near here by Manuel Hernandez Acevedo. The water power for operating the plant will be obtained by constructing a dam across the Santa Maria River at a point nine miles east of this place. The electric power will be supplied to the town of Santa Maria del Rio.

CHILPANCINGO, MEX.—It is announced that the Mitchell Mining Company, which is operating extensive copper mines in this state, has under consideration the establishment of large electric power plants. The company has acquired two waterfalls, one capable of providing 20,000-hp and the other 1,500-hp. The plans of the company contemplate the construction of an electric railway between the mines and the port of Acapulco, a distance of 31 miles. This road will be used to transport the ore and other freight of the company. John F. Dowling can give further information in regard to the projects.

FREDERICTON, N. B.—Bids will be received Oct. 15 by Chas. W. Beckwith, City Clerk, for $15,000 electric light bonds.

STRATFORD, ONT.—H. M. Sloan, of Chicago, and Dr. McKay, of Ingersol, have petitioned Council for a 50-year franchise to supply electricity for lighting and power.

BERLIN, ONT.—The Town Council has voted $70,000 to the Light Commissioners to be used for improvements to the electric light and power plant recently purchased by the city. In place of steam, coal gas engines will be installed.

THE ELECTRIC RAILWAY.

DOVER, DEL.—A contract has been awarded to the Tennis Construction Company for building the electric railway from Chesapeake City to Elkton, Md. The ultimate aim of the parties who control the line is to build a connection at the State line, with an extension via Newport, Del., Stanton and Newark, Del., and from Chesapeake City to Fredericktown, across the Sassafras River, to Chestertown, Md., with a branch probably from Chesapeake City to Middletown, Del., thus completing a circuit via Delaware City and New Castle to Wilmington, Del. If this last arrangement is carried out, the line will undoubtedly be continued down the State to Smyrna, and thence on through to Rehoboth, giving the entire peninsula a complete electric railway for freight and passenger business.

EAST ST. LOUIS, ILL.—The East St. Louis & Columbia Electric Railway Company has been incorporated with a capital of $45,000. The incorporators are Thomas N. Chase, J. P. Meyers and John Pickhaw.

MARSEILLES, ILL.—The Streator Manufacturers' Railway has been incorporated to build a railroad from Ottawa, Ill., to Marseilles and to Streator. The capital stock is $25,000, and the incorporators are Frank R. Davidson, John F. Clark, Charles H. Adams and others.

CHARLESTON, ILL.—Articles of incorporation have been filed at Springfield by the Charleston, Champaign & Northern Interurban Railway Company. The principal offices will be at Charleston, and the capital is $10,000. The incorporators and first board of directors are W. R. Patten, W. F. Jenkins, J. B. Mitchell, C. L. Lee and J. L. Shisand, of Charleston.

DECATUR, IND.—The Springfield & Fort Wayne Electric Railway Company is preparing plans for a new power house.

CAMBRIDGE CITY, IND.—The Richmond Street & Interurban Railway Company will in the spring convert the Red Whitewater Division of the Big Four from Hagerstown to Connersville into a traction line.

FT. BRANCH, IND.—The Evansville & Princeton Electric Railway Company, whose power house is situated in this place, has made a proposition to install a system of electric lights for this city and it is thought the council will ratify the proposition.

TERRE HAUTE, IND.—The County Commissioners have granted a franchise to the Western Traction Company to build an electric railway from the south line of the county to Terre Haute. Samuel Williams, of Vincennes, is president of the company.

SIOUX CITY, IA.—Negotiations have been pending for the purchase by the Sioux City, Homer & Southern Railway Company of a right of way across the Winnebago and Omaha Indian reservations. This seems to point to the certainty of the extension of the line from Homer to Omaha. The Omaha Northern Railway Company owns a right of way over these reservations, but has never done anything as yet to construct the line from Omaha to Sioux City.

LOUISVILLE, KY.—The promoters of the Louisville, New Albany & French Lick Valley Traction Company have practically abandoned the plan to construct the line, and there is now an opening for some other company to build it. It is presumed that the Louisville & Southern Indiana Traction Company will take over the franchises and build the line.

BALTIMORE, MD.—William P. Lyons, of Baltimore, has been appointed co-receiver of the Washington, Baltimore & Annapolis Railway Company.

BURLINGTON, MASS.—The town of Burlington has instructed the Board of Selectmen to grant a location to the Middlesex Street Railway Company, which proposes to construct a line between Arlington and Lowell, with rails in Arlington, Bedford, Burlington and Billerica. The route, so far as possible, will be over private land and a double track will be laid.

CADILLAC, MICH.—The Cadillac Traction Company, recently organized, will build a line to skirt Lake Cadillac. The company has purchased the electric light, power and water plants of the city, and will operate the street railway in connection with them. The company has been granted a franchise which will aggregate about 10 miles of track in Cadillac proper and around Lake Cadillac, passing Lake Mitchell. The officers of the company are Willis J. Cornwell, president; John F. Vasberg, vice-president; George S. Hanley, secretary; Francis O. Gaffney, treasurer; James H. Orr, manager and purchasing agent.

JOPLIN, MO.—An Eastern syndicate, headed by Major William Vincent, of the United States Guarantee Loan & Trust Company, of New York, proposes to build an electric railway between Joplin and Kansas City. The road will be 170 miles long. It is the intention of the company to do a general freight as well as passenger business.

LINCOLN, NEB.—In response to appeals of its employees the Lincoln Traction Company has raised the wages of first-class conductors and motormen one cent per hour, taking effect October 1.

DOVER, N. J.—The Morris County Traction Company is making plans to extend its lines from Dover to Morristown.

JERSEY CITY, N. J.—The Keeler Transportation Company has been incorporated here, capital $500,000. Incorporators: Frank R. Baldwin, Elmer A. Keeler and Martin A. Ryan.

UTICA, N. Y.—The directors of the Utica & Mohawk Valley Street Railway Company have re-elected the present officers.

BINGHAMTON, N. Y.—The Montrose Railway Company has voted to issue bonds to the amount of $100,000, and it is reported that the line will be extended through to Binghamton. It has been decided to widen the road to standard gage, to buy a right of way into Montrose, and to build the necessary trackage and station.

MIDDLETOWN, N. Y.—It is understood that negotiations are on for the extension of the power lines of the Honk Falls Power Company from Ellenville to Middletown, a distance of more than 20 miles, so as to supply power to both the Middletown-Goshen Electric Railway Company and the Consumers' Light & Power Company.

NEWARK, OHIO.—The Newark, Martinsburg & Mount Vernon Traction Company has amended its articles of incorporation to authorize the construction of branch lines through Martinsburg, Gambier and Wooster.

CINCINNATI, OHIO.—The Cincinnati, Dayton & Toledo Traction Company will install a new generating unit at its Spring Grove Avenue power house, and it is probable that a new power house will be erected at Hamilton to improve the condition of the city service.

MANSFIELD, OHIO.—Hon. S. M. Douglass, of Mansfield, is at the head of a project to build an electric railway from Mansfield to Akron by way of Wooster and Orrville. The company has not yet been incorporated, but it is stated that practically all the required right of way has been obtained.

GENEVA, OHIO.—C. W. Goodrich has filed a petition with the County Commissioners for a franchise for an electric railway through Ashtabula County, from Geneva to Jefferson, and thence to Meadville. The right of way for this line has all been secured and engineers have made a survey of the same.

YOUNGSTOWN, OHIO.—The Youngstown & Southern Railway Company and the Youngstown & Salem Railway Company have been consolidated into one corporation to be known as the Youngstown & Southern Railway Company; capital, $1,800,000. A. W. Jones, John Ruhmann, W. H. Ruhmann, J. R. Long, W. S. Andrews and R. L. Andrews are the directors.

EAST LIVERPOOL, OHIO.—L. W. Healey, manager of the United Power Company, of East Liverpool, has applied to the Jefferson County Commissioners for a franchise to extend the company's line from Wellsville to Empire. The object of the extension is to connect with the line of the Steubenville Traction & Light Company, now completed to Empire. This would give a continuous line from East Liverpool to Wheeling.

GUTHRIE, OKLA.—The Blue Island, Riverdale & Hammond Street Railway Company, of Oklahoma City, has been incorporated with a capital stock of $1,500,000. The incorporators are William F. Owen, August W. Miller, John F. Noel, Ira J. Owen, W. S. McCaull and Frank E. White, of Chicago; W. F. Harn, T. F. McMechan and John Threadgill, of Oklahoma City.

HARRISBURG, PA.—Control of the West Fairview & Marysville Electric Railway has passed into the hands of the Harrisburg & Mechanicsburg Street Railway Company.

OXFORD, PA.—The Town Council has granted the right to lay tracks to the West Chester, Kennett & Wilmington Electric Street Railway Company. The projectors promise to have the road in operation by the new year.

BEAVER, PA.—The Beaver Valley Traction Company will extend the Morado line to Homewood, and may extend the Monaca line to Aliquippa Park. Surveys for both extensions have been made. It is reported that the company will build an extension to Ellwood City.

CHAMBERSBURG, PA.—The Chambersburg, St. Thomas & Fort Loudon Electric Railway Company has been organized to build an electric railway from Chambersburg to St. Thomas and Fort Loudon. The officers of the company are John R. Eberly, president; Frisby Miller, secretary; Dr. F. G. Strock, treasurer.

CONNELLSVILLE, PA.—A charter has been granted the Monongahela & Clairton Street Railway Company. The incorporators are Paul W. McCully, W. P. Whitledge, John G. Parke, Jr., Culin Armstrong, William H. Lewis, B. W. Castner, John W. Ailes, William H. Binns, J. N. Mullin and Oliver S. Scott. The capital stock is $75,000.

LANCASTER, PA.—Mr. W. F. Given, president of the Lancaster County Railway & Light Company, has resigned his position, owing to the discovery of a shortage in his accounts of over $100,000. Mr. Given was also president and director of the Columbia Trust Co., both of which offices he has resigned. It is stated that in large part he has made restitution and that the stockholders of the Lancaster County Company will not suffer a severe loss. According to reports, Mr. Given did not owe the Columbia Trust Company anything. It is stated that he was a plunger in the stock market. He was regarded as a man of great wealth.

GEORGETOWN, S. C.—The proposed electric railway at Georgetown has resulted in the application for a commission from the Secretary of State by R. M. Barnes, Jos. B. Johnson and others. The capital stock will be $10,000. The company also asks for the right to furnish light and power.

MEMPHIS, TENN.—The Memphis Street Railway Company will extend its line from Buntyn, a suburb of Memphis, to Colliersville, Tenn., a distance of 18 miles.

AUSTIN, TEX.—The law passed by the Texas legislature at its last regular session requiring all street railway companies operating lines in this state to place vestibules on their cars is being generally observed. All cars will be equipped with vestibules by the time the winter season opens.

NEW BRAUMFELS, TEX.—The project of building an interurban electric railway between this place and San Antonio is being considered by capitalists. The distance is about thirty miles. This is one of the greatest pleasure resorts in Texas and thousands of people are attracted here. The most abundant water power in the state is afforded in the Guadalupe river at this place and if the project is carried out the power station will be located here. Colonel Harry Landa, of New Braumfels, can give information.

MADISON, WIS.—The Chicago & Northwestern Lake Electric Railway Company has filed an amendment to its charter, with the Secretary of State, providing for the construction of a branch line from the state line, in Kenosha County, into the city of Milwaukee, 45 miles.

OSHKOSH, WIS.—The Eastern Wisconsin Railway & Light Company, which has in contemplation the construction of an electric railway between Oshkosh and Fond du Lac and through contiguous territory, has just filed articles of incorporation with the Secretary of State of Wisconsin. The capital of the company is $500,000, and the directors are Frank B. Hoskins, Benjamin Wild, Sr., and Leander Choate.

LEGAL.

WESTERN UNION VS. BELL TELEPHONE.—The United States Circuit Court of Appeals, sitting at Boston, has sent down a decree in the case of the Western Union Telegraph Company et al. vs. the American Bell Telephone Company, reversing the decision of the circuit court, which confirms the master's report. The master's report held that the plaintiff could not recover in the suit seeking an accounting for certain shares of stock in the companies licensed by the Bell Company, under a contract made in November, 1879. Now the court of appeals holds that the plaintiff can recover. The amount involved is very large. This decision marks the end of a legal contest which has been in and out of the courts for almost twenty years. The suit was brought originally by the Western Union Telegraph Company in 1884 to recover 20 per cent. of certain telephone profits of companies licensed by the Bell Telephone Company which had taken over certain telephone patents and companies of the Western Union under a contract made in November, 1879, whereby in exchange for those patents the Western Union was to receive the royalty above stated. The contract gave the Bell Company the exclusive license for the Western Union patents or any extensions. The Western Union also agreed to acquire certain other patents, application for which were pending and to license the Bell Company under them. It also stipulated that if it should thereafter acquire any telephone patents, the Bell Company should have the right to use them. It agreed to withdraw from the manufacture, rental and use of telephones and gave the field to the Bell Company. It also agreed to transfer telephone exchanges it had established. The Bell Company was to give the Western Union 20 per cent. of the rentals for royalties. Shortly after making the contract the Bell Company changed its methods of business and began to give licenses to use telephones for rentals and for stock. The Western Union contended that the stock received was as much rental as the money rental. Rush Taggart says: "We do not know the amount in question until an accounting is rendered. We believe the sum to be a large one. It may be between $2,000,000 and $4,000,000." There seems a likelihood that the case may be appealed.

SUIT AGAINST U. G. I.—Charges against the United Gas Improvement Company to the effect that it has made a secret and illegal profit of $20,000,000 in the stock of the United Electric Company of New Jersey are made in a bill in equity filed in Common Pleas Court No. 1, Philadelphia, in behalf of Col. Allan B. Wallace, of Summit, N. J. It is alleged that the Philadelphia corporation promoted the New Jersey concern for the purpose of subsidizing a number of electric light and power companies in and around Newark and Jersey City. It is said that the U. G. I., in the spring of 1899, through Frank M. Stillman, William J. David and others, formed the New Jersey corporation with an authorized capital of $20,000,000, divided into 200,000 shares of the par value of $100 each. David became president, Stillman, secretary, and the other representatives of the U. G. I. formed with them the directorship of the concern. It is explained that at this time there were about twenty smaller companies around Newark and Jersey City engaged in the electric lighting and power business. In order to get control of these the U. G. I. offered, through the Fidelity Trust Company of Newark, to buy stockholders' holdings with the United Electric bonds. It also offered to sell the balance of the bonds of the United Electric Company to them for $30 a share. The scheme proved successful and the directors of the United Electric Company made a bond issue of $20,000,000 and turned the securities, together with the stock, over to the U. G. I. At this time Col. Wallace was a shareholder in the People's Light & Power Company, a subsidiary concern. It is complained that the U. G. I. did not disclose to the purchasers of the bonds and stock of the United Electric Company that it was getting the entire issue of the stock as a profit, or bonus, for promoting the organization, and that the receipt of its stock by its agents in the capacity of directors without full disclosure was illegal. It is also contended that the whole transaction was in fraud of the rights of the electric company and of those who purchased the stock from the U. G. I. A full discovery of all profits is asked for and when these have been ascertained the court is asked to order the U. G. I. to turn them over to the electric company and to declare the assignment of the $20,000,000 stock to the U. G. I. invalid. The U. G. I. people state that they know little or nothing of this matter.

OBITUARY.

MR. F. D. OLMSTED, assistant chief engineer of the Telluride Power Company and the Power Company of Montana, died in Denver, Colo., October 4, of tuberculosis and heart trouble, after a short, acute illness. Mr. Olmsted has been associated with these companies for the last five years. He was an Ann Arbor man, and previous to his connection with the Telluride Power Company was with the Edison Electric Company, of New York City. He had done a great deal of very creditable original work in hydraulics with these companies. He was also associated with Mr. P. H. Thomas, of the Westinghouse Electric & Manufacturing Company, in original research on static strains produced by interruptions of high tension long distance circuits. Mr. Olmsted was highly thought of, both for his technical ability and his personal character, by all of his associates, and the Telluride Power Company feel they have lost one of their best men. He died on his twenty-eighth birthday. He was a junior member of the American Society of Mechanical Engineers.

COL. R. H. SAVAGE.—We regret to note that Col. Richard Henry Savage, the soldier, author, traveler and scientist, died on Sunday, October 11, in New York City, from injuries which he received on the night of Oct. 3, when he was knocked down and run over by a wagon. He was well known by his literary works, of which he had published about thirty volumes of prose and poetry, many of which have been translated and sold on the Continent of Europe. His first novel, "My Official Wife," has been translated into seventeen languages, besides being dramatized and burlesqued. He was born in Utica, N. Y., on June 12, 1846. He went to San Francisco at an early age, where he was one of the first public school children in that city. While in the West he became acquainted with frontier life, and saw the workings of the Vigilance Committee formed by the early settlers in those parts. At the age of twenty-two he was graduated from the West Point Military Academy with the highest honors. From the Academy he went into service on the Western frontier. Col. Savage then went to Egypt, where in 1871 he entered the Egyptian Army as Major, serving for one year, at the end of which he received an honorable discharge. At various times he was Vice Consul at Marseilles and at Rome. He was Commissioner in Texas in 1872-3 to settle the Mexican-Texas border dispute. For fourteen years Col. Savage carried on geographical studies which carried him over most of the globe. When war was declared against Spain Col. Savage was one of the first to volunteer his services to the Government. He was assigned to the command of the First Battalion United States Volunteer Engineers.

PERSONAL.

MR. C. J. H. WOODBURY, M. E., has changed his Lynn, Mass., address to 51 Baltimore Street.

MR. C. A. BENTON, of the Marine Engine & Machine Company, has sailed for Europe this week, and will be over there some little time.

MR. E. E. STARK, of the Bay Counties Electric Power Company, California, has been appointed electrical engineer for the Waipori Falls Electric Power Company, New Zealand.

MR. JAMES C. HOBART, manager of the Triumph Electric & Ice Machine Company, of Cincinnati, was in Chicago the past week, looking after some important interests of his company.

MR. A. W. HENSHAW, formerly with the General Electric Company, at Schenectady, will henceforth have charge of the motor department of the Stanley Electric Mfg. Company, Pittsfield, Mass.

MR. JOHN MUSTARD, who was formerly with the Wagner Electric Mfg. Company, has opened an office at 1617 Real Estate Trust Building, Philadelphia, where he will handle several lines of electrical specialties.

MISS CECILE WOODWORTH has painted an admirable portrait of the late John W. Mackay, head of the Commercial Cable & Postal Telegraph interests. It has been on exhibition the past week at the Schaus galleries in New York City.

MR. H. H. VREELAND, president of the Interurban Street Railway Company, of New York City, has started with $1000 a fund for the Department of Railway Engineering at Sibley College, Cornell University, to be used in starting a laboratory for that department. The building will cost between $10,000 and $15,000.

MR. J. F. MAC WILLIAMS, the superintendent of the Meridian, Miss., Light & Railway Company, has resigned and has accepted a similar position with a company with headquarters in Chicago. His place has been taken by Mr. H. M. Blackington, formerly superintendent of construction for Ford, Bacon & Davis, at Birmingham, Ala.

MR. J. C. MURRAY, formerly with the Kellogg Company and later with the Stromberg-Carlson Tel. Mfg. Company, has resigned his position with the latter company to engage with the International Telephone Mfg. Company, of Chicago, as traveling representative. Mr. Murray will cover Indiana and Michigan.

PROF. W. E. AYRTON, F. R. S., member of the Mosely Educational Commission from England, arrived here last week and has since been very actively engaged in connection with that work. He has found, however, a host of old electrical friends in this country who have gladly seized the opportunity to meet him once again. He will spend about three weeks in America. Prof. Ayrton will deliver a lecture before the New York Electrical Society in the lecture room of the American Institute, 19 West 44th Street, New York, Monday, Oct. 19, at 8 p. m. His subject will be "An Informal Talk on Some Electrical Measuring Instruments and Recent Use of Them."

MR. WARD BARNUM, who for several years has been superintendent of the Cincinnati, Newport and Covington Light & Traction Company has been appointed electrical engineer for the Louisville & Nashville Railroad system with headquarters at Louisville. He will have supervision over all the electrical work of the entire system, including the large shops now under construction at Louisville. He assumed his duties October 1.

SIR CHARLES METCALFE, chief engineer, etc., of the South African Chartered Company, which proposes to develop electro-hydraulically the power of the great Victoria Falls on the Zambesi River, arrived in this country last week from England to study power development here, including that at Niagara. He was met by Mr. George Westinghouse at the pier. The Victoria Falls are reputed to be three times as high and twice as wide as Niagara.

MR. JOHN A. DREW.—The Brooklyn Engineers' Club held the first meeting of the season on the evening of October 8. Besides the usual formal business, a very interesting paper entitled "A History of Pumps, Ancient and Modern," was read by Mr. John A. Drew, of the Worthington Company. Mr. Drew sketched the development of pumping machines from the early Egyptian "noria," resembling the familiar well sweep, to the latest triple-expansion, condensing, water-works pumping engines, requiring little more than a pound of coal per horse-power-hour. The paper was illustrated by a large number of lantern slides.

MR. STEVEN F. FR. DE CSESZNAK, called at the office of ELECTRICAL WORLD AND ENGINEER this week on his return from a four months' trip in Europe. He reports the prospects for business on the other side of the Atlantic as particularly good, and says that American apparatus is growing in favor in all of the European countries he visited, especially in Russia, where the industrial outlook and financial conditions are both excellent, and where

American machinery is regarded with the greatest favor, not only because of its superiority, but also on account of the dislike which the Russian has to dealing with some of the other nations. An electric light plant is being installed in Moscow, and a large corporation for the construction of electric railroads through the Russian Empire has been formed in St. Petersburg. The larger portion of machinery and supplies to be used will be purchased in the United States.

MR. CHARLES CHURCHILL, managing director of Charles Churchill & Company, Limited, of England, which concern is the largest handler of American labor-saving devices in Great Britain, is now on a visit here. Mr. Churchill is an American by birth and was the pioneer importer of Yankee machine tools on the other side. His company handled $1,000,000 worth of machinery within the last twelve months. He looks for a steady demand right along. The company recently secured substantial contracts from the British Westinghouse Electric & Manufacturing Company, the British Thomson-Houston Company and other electrical concerns operating large British plants; also for various equipment for the Woolwich arsenal. The Churchill Company represents the British interests of nearly 100 American manufacturers, including the W. F. & John Barnes Company, of Rockford, Ill., the Cincinnati (O.) Milling Machine Company, etc. Mr. Churchill is making his headquarters at the American Gas Furnace Company's offices, 23 John Street. He will be in this country until the end of November.

EDUCATIONAL.

DELAWARE COLLEGE, DEL.—The college opens with the largest and best prepared class in its history. Over 70 per cent. of the new students will take the engineering course. Of the new men, 11 have registered for the electrical course under Prof. Wood. The enlargement of the shops is nearly completed, giving an addition of over 5,000 sq. ft. of floor space. A part of this will be used for the new electrical laboratory and dynamo room, and the new schedule for the course requires laboratory work, to a greater or less extent, from all of the seventy-five engineering students. Mr. L. A. Fruedenberger, a graduate of Lehigh University, who has taught in the electrical department there for over a year, was recently appointed instructor in electrical and mechanical engineering. Mr. Freudenberger's work on the investigation of train acceleration is known to the readers of ELECTRICAL WORLD AND ENGINEER. The entire electrical work is being brought up to a standard of proficiency which should insure thoroughness in the most advanced branches of the science.

Trade Notes.

MR. E. O. WAYMIRE, of the Dayton Fan & Motor Company, has been in New York for the past ten days.

OIL FILTERS FOR GERMANY.—Eighteen Cross oil filters have just been shipped to Witten, Germany, by the Burt Mfg. Co., Akron, Ohio.

THE TRANSIT FINANCE COMPANY, of Philadelphia, announces the removal of its offices to the Land Title Building, Broad and Chestnut Streets.

L. B. ALLEN CO., INCOR., of Chicago, has issued a neat pamphlet on its soldering paste. The book is envelope size and is accompanied by a loose sheet price list, which any of our readers may have by writing for it.

ARC LAMPS FOR STEEL WORKS.—The Carnegie Steel Company has purchased through the Doubleday-Hill Electric Company, of Pittsburg, 250 Adams-Bagnall arc lamps for its new Donora works.

EXHAUST HEADS.—The Baldwin Locomotive Works, Philadelphia, Pa., has just sent their thirteenth order for Burt exhaust heads to the Burt Mfg. Co., Akron, Ohio. The Baldwin Company now has 39 Burt exhaust heads in use in its plant.

JOHNSTON, LIVINGSTON, JR. & COMPANY, successors to the electrical construction department of the United Engineering & Contracting Company, announce removal to their new building at 113 East Twenty-Second Street, New York City.

HARVEY HUBBELL, Bridgeport, Conn., has brought out catalogue and price list No. 7, devoted to his high grade electrical specialties, in such lines as pull sockets, pull clusters, attachment plugs, shade holders, chandelier and other switches, insulating joints, etc. To all of these great ingenuity, excellent workmanship and good material have been applied.

THE ELECTRIC APPLIANCE COMPANY, Chicago, writes that it will be pleased to send its new catalogue to those in the trade, by prepaid express. Applications coming from its territory, which takes in the United States except the Eastern States, will have prompt attention, if accompanied by business card. Its catalogues are claimed to be the latest and most comprehensive electrical supply catalogues issued by any house.

HALLER MACHINE COMPANY, 127-129 Fulton Street, Chicago, has issued a neat 8-page quarto size circular as to its sign department. The concern makes letters for electric signs, "raised" or "box," as well as "sunken" or "grooved" letters. These letters make admirable signs. They take a durable glossy surface finish, reflecting excellently the light from the lamps. The concern build up also complete electric signs.

THE EUREKA ELECTRIC COMPANY, of Genoa and Chicago, has lately furnished new switchboard and telephone equipment to no less than 19 exchanges situated in Indiana, Wisconsin, Illinois, Minnesota, Iowa, Pennsylvania, Georgia, Tennessee, Missouri and Nebraska. The Eureka Company is now well settled in its new plant at Genoa, Ill., with increased capacity and better able to take care of customers than ever in the past.

THE SHELBY ELECTRIC COMPANY, manufacturers of Shelby "useful light" incandescent lamps, has made an important change in its New York office. While the office is still in the Parker Building, No. 225 Fourth Ave., Mr. Wormley, who has been in the employ of the company as manager of the branch, has been relieved, and Mr. W. G. McKennan, who has been with the company for a number of years, will hereafter have charge of the sales department. The telephone number of the New York office is No. 18—18th St.

LA HARPE METAL.—The success of sheet zinc under this brand has led the Lanyon Zinc Company, sole manufacturers of "La Harpe Metal" to specialize certain of its products for the various requirements of the electrical trade. For spinning, stamping or drawing, and forming to special shapes, the sheet zinc of this brand has won an enviable position amongst the materials available to manufacturers. The long experience of the Lanyon Zinc Company as the largest producer of zinc in this country insures a quality which users are not slow to recognize.

ASBESTOS PRODUCTS.—A unique postal card is being sent out by the H. W. Johns-Manville Company, 100 William Street, New York, setting forth the advantages of asbestos filtering cloths and of asbestos "Vitrex" retort cement. It consists of a sheet folded in three sections to a size equal to that of the ordinary postal card. On one of the sections is the address, and another section is perforated that it may be used to mail with an inquiry asking quotations. Between two of the sections and glued on the face of one of them are two specimens about two inches square of asbestos filtering cloths. Truly this is an instance of *multum in parvo*.

BANNER LAMPS.—Conclusive proof of the steadily increasing popularity of Banner lamps is furnished by the fact that several times during the past two years the company has found it necessary to make important additions to its plant at Youngstown, Ohio. In order to furnish sufficient power for the enlarged factory a new power house is being constructed. This building, which will be isolated from the rest of the plant, will contain a direct connected 60-hp Walrath gas engine now under construction. Next to quality, the Banner Company prides itself on prompt deliveries, and with its increased facilities, orders will be filled even more punctually than in the past.

STORAGE BATTERY FANS.—It has been asserted pretty often that if an efficient storage battery could be devised which would operate without liquid electrolyte, the problem of the operation of fans and other small machines would be solved. The National Battery Fan Company, of 14 South Broad Street, Philadelphia, Pa., has, it is claimed, combined the principles of the primary and secondary battery, and so utilized these principles as to retain all the advantages of the primary battery while providing for its being recharged at a nominal cost, and producing a dry battery capable of being shipped like ordinary merchanidise by express or freight to any part of the country.

THE NERNST LAMP.—This is the title of a special publication just issued by the Nernst Lamp Company, of Pittsburgh. It is a 24-page brochure, octavo, handsomely printed and illustrated. Its really valuable feature is a treatise by Mr. A. J. Wurts, electrical engineer of the company, which constitutes in popular form a digest of all the data and all the arguments bearing upon the beauty, utility and superiority of the lamp which Mr. Wurts has done such admirable work upon in this country. The cuts include a number of excellent curves dealing with current consumption voltage, candle power, efficiency, etc. Diagrams are also given showing the construction, circuit connections, etc. We can imagine a big demand for this well-conceived and well-executed pamphlet.

SAUTTER, HARLE & COMPANY, of 26 Avenue de Suffren, Paris, have just issued, in English, an excellent and interesting pamphlet on high pressure centrifugal pumps, of the Rateau system, for mining purposes. These pumps are shown and described in the pamphlet connected to electric motors of various types and in different positions, and a list is given of plants that have been equipped. Data are also furnished with regard to turbo-pumps, in which an even higher speed than that of motors is attained. An instance is given of the turbo-pumps in the Bruay mines, Pas de Calais, which raise a single jet of 250 cubic meters per hour to a height of 350 meters, the unit developing 500-hp. Both centrifugal and multicellular electric pump installations are brought to notice. The steam turbines referred to are, of course, those lately brought forward by Prof. Rateau.

TRANSFORMERS.—The General Electric Company has added to its list of pamphlets on transformers two new publications, one entitled "Core Type Transformers," and the other "Permanency of Transformer Insulation." Both of the pamphlets are gotten up with the excellent taste that characterizes the productions of the General Electric Press. The former, which is a reprint of an article appearing in these columns, with additional illustrations, describes in detail the core type of transformer, curves being included of core losses and regulation, comparative curves of copper losses, and curves showing the reduction in core losses that has been brought about in recent years by improvements in transformers. The other pamphlet discusses the requirements of transformer insulation, and shows how these are improved by the vacuum drying and compound filling process employed by the General Electric Company.

SKINNER AUTOMATIC ENGINES.—At this season of the year, the central station manager, after thinking it over all summer, is making active preparations for the winter's business. His entire equipment is being overhauled and very often he finds that further engine capacity is required. In a majority of such plants, the automatic engine enjoys great vogue, and in an investigation of this subject, the manager cannot fail to be impressed with the good qualities of the Skinner automatic engine. It embodies features which combine to make it durable, economical, close regulating and easily cared for, and up-to-date. Some original features embodied in its design may be mentioned as follows: a frictionless governor, requiring no oil, a frictionless outside connection, no eccentric and strap being required, a valve which is guaranteed steam tight for five years and, furthermore, automatically takes up

wear, relieving the cylinder from water; an automatic oil and water separator, the oiling being automatic and in plain sight of the operator; entirely replaceable shaft boxes not requiring the removal of the shaft; a permanent alignment device; a self-aligning out-board pedestal bearing; entirely removable top and bottom guides; a shifting eccentric for low pressure cylinder on compounds; a combination piston stuffing box on tandem compounds, wedge and screw adjustment on all important bearings, and entirely removable polished oil shields rendering the engine accessible, while absolutely preventing the escape of oil. In fact the popularity of the Skinner automatic engine has compelled the company to increase its facilities. A new building 75x180 feet with main bay and two lean-tos, is now being erected, and will be completed the first of the year. This will embody the most improved features of construction, galleries being provided in the lean-tos for the light work, whereas the heavier and erecting work will be done in the main bay, by the aid of an electric traveling crane. An entirely new equipment of modern labor saving tools, electrically driven, will be installed. This addition will practically double their capacity and permit them to turn out larger engines than formerly as well. The last month's business is the largest in the history of the company, the sales in three of the largest cities in the country aggregating over thirty engines.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCTOBER 6, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

739,978. MINE GATE; Newton K. Bowman, North Lawrence, Ohio. App. filed Jan. 13, 1903. A gate arranged across the track of a mine railway and which is made of collapsible material, carries a bridge on its lower edge which comes in contact with a trolley wire mounted just above the gate, when the lower part of the gate is lifted to allow a car to pass. The bridge carries the trolley wheel uninterruptedly past the gate.

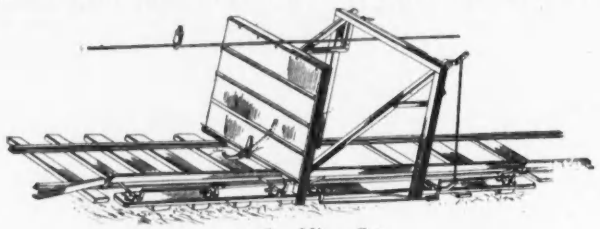
740,273. MOTOR CAR; Robert H. Hassler, Indianapolis, Ind. App. filed Nov. 20, 1902. A gas engine, a dynamo driven thereby, an electric motor geared to the vehicle and a controller for electrically connecting the dynamo with the motor and simultaneously shifting the sparking time of the engine.

740,379. ELECTRIC FURNACE FOR THE MANUFACTURE OF FILAMENTS; W. L. Voelker, Erie, Pa. App. filed March 15, 1902. A small electric arc furnace in form of a crucible through which the filament is passed at a short distance from the axis of the electrodes, and means for deflecting the arc into the path of the filament. The crucible may be charged with hydrocarbon reducing gases.

740,385. ELECTROTHERAPEUTIC APPLIANCE; William B. Bassell, Columbus, Ohio. App. filed Dec. 8, 1902. A cap for the head, having opposed electrodes arranged therein so that current can be directed through the head when the cap is worn.

740,428. SPARK GAP; John O. Heinze, Jr., Lowell, Mass. App. filed May 20, 1903. To prevent an arc from rising between the surfaces of a spark gap, the surfaces are arranged on an incline, thus controlling the current of heated air which influences the arc.

740,447. MEANS FOR REGULATING ALTERNATING CURRENT CIR-



739,978.—Mine Gate.

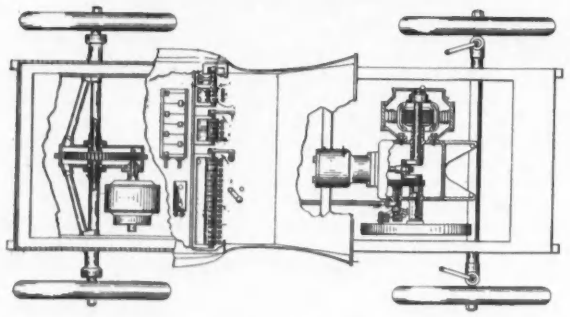
CUITS; Waldo A. Laymann and Ferdinand Schwedtmann, St. Louis, Mo. App. filed Nov. 23, 1901. The number of sections of a transformer in circuit is controlled by an electro-magnetic switch, the current for operating which is itself controlled by the current in the transformer circuit.

740,450. AUTOMATIC FIRE ALARM AND SPRINKLER SYSTEM; Frank K. Ludlow, Cincinnati, Ohio. App. filed March 3, 1902. The starting of a sprinkler actuates an alarm circuit.

740,461. ELECTRIC LIGHTING APPARATUS FOR RAILWAY CARS; Roger M. Newbold, Birmingham, Ala. App. filed Nov. 15, 1902. Resistance in the field magnet circuit of the dynamo is controlled by the action of a solenoid in the main circuit opposed by a predetermined weight.

740,505. AUTOMATIC BLOCK SIGNAL SYSTEM; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Feb. 1, 1902. The devices comprise relays having neutral and polarized armatures, pole changers in the track circuit each connected to the home signal of the next section in advance and slow release relays having a release so slow as to prevent the momentary reversal of current in the neutral polar relay from changing the signal through the momentary release of the neutral armature thereof.

740,512. APPLIANCE FOR SOUND-TRANSMITTERS; Samuel Judson Ballard, Los Angeles, Cal. App. filed May 14, 1900.



740,273.—Motor Car.

740,548. ELECTRIC SHOE; John W. Gibbs, New York, N. Y. App. filed July 16, 1903. The insole has a number of pairs of electrically opposed disks across which the circuit is closed by the foot.

740,577. TROLLEY POLE; Joseph F. Mackin, Columbus, Ohio. App. filed April 25, 1903. The trolley pole is made up of a system of levers in the style of a parallel ruler, permitting it to shift laterally without tipping the wheel.

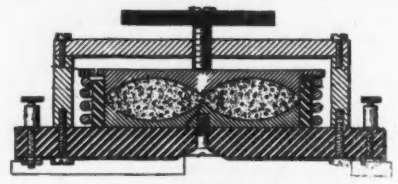
740,585. SYSTEM OF ELECTRICAL CHARACTERS AND MEANS FOR FORMING SAME; Dennis J. O'Brien, San Francisco, Cal. App. filed Nov. 3, 1902. A lamp used for signs consisting of a tube having end-caps from one to the other of which a filament is stretched, one end of the filament being spring supported to permit it to expand and contract.

740,635. BRUSH HOLDER; Charles A. Eck, Belleville, N. J. App. filed Feb. 12, 1903. Adjacent to the brush guide is a cylinder containing a spring operated plunger from which a finger projects to engage with the back of the brush, the finger carrying a pivoted plate for holding the brush in position and for removing the brush from its seat.

740,663. ELECTRICAL OUTLET BOX; Hubert Krantz, New York, N. Y. App. filed May 25, 1903. The neck or outlet sleeve from the box can be lengthened or shortened by means of interlocking extension sections and screw bolts for determining their position.

740,671. PORTABLE ELECTRIC LIGHT; Harold S. MacKaye, Yonkers, N. Y. App. filed May 19, 1903. Details.

740,707. TROLLEY; Bruno Stenvall, New York, N. Y. App. filed March 21, 1903. The pole carries two horizontally arranged wheels and is made up



740,787.—Rheostat.

of two rods pivoted to the base and to the wheel frame in such a manner as to always maintain the axis of the wheel in the same horizontal plane.

740,744. POLARIZED ELECTRIC BELL; Frank B. Cook, Chicago, Ill. App. filed Dec. 18, 1902. (See page 646.)

740,745. ELECTRIC CUT OUT; John Erikson, Providence, R. I. App. filed Mar. 5, 1902. A glass plug around the inner walls of which the fuse runs so as to be seen from the outside; the fuse is covered with a material which becomes discolored by the heat when the fuse is melted.

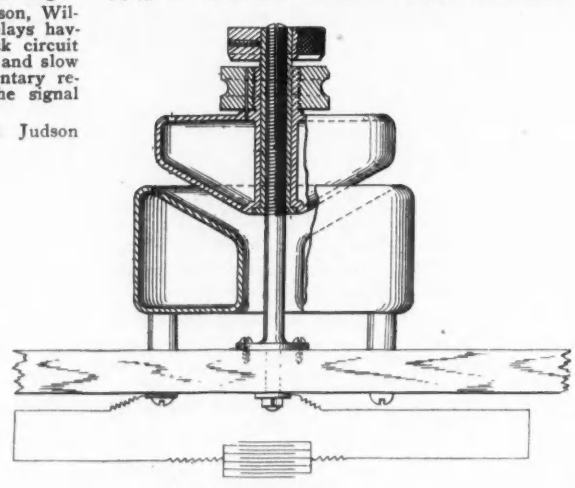
740,787. RHEOSTAT; Joseph C. Vetter, Astoria, N. Y. App. filed Nov. 19, 1902. Two cup-shaped plates adjustable in distance from each other confine between them a mixture of granular elastic non-conducting material, and granular, inelastic conducting material; the conductivity is changed by bringing pressure to bear upon the mass.

740,823. FIRE SIGNAL; John H. Dixon, Pittsburg, Pa. App. filed Sept. 26, 1901. Wires held under tension and strung throughout the protected area, include fusible joints, the separation of which causes a signal to be given.

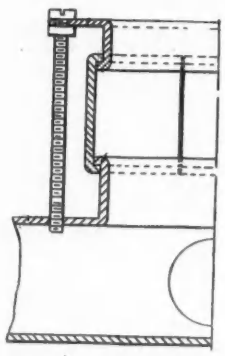
740,831. RHEOSTAT; August Eimer, New York, N. Y. App. filed Dec. 3, 1902. The resistance bodies are located on a removable support and are surrounded by cooling devices.

740,873. APPARATUS FOR TREATING SKIN DISEASES; Jakob Kjeldsen, Copenhagen, Denmark. App. filed Oct. 23, 1900. An arc lamp having metallic electrodes the light from the arc being directed through rock crystal windows to form a linear spectrum with a surplus of violet rays.

740,912. RAIL BOND; Louis Pfingst, Dorchester, Mass. App. filed July 16,



740,428.—Spark Gap.



740,663.—Outlet Box.

1902. A double bond having the respective ends connected together through two openings in the web of the rail.

740,952. SWIVEL ATTACHMENT PLUG FOR ELECTRICAL CONNECTIONS; Tycho Van Aller, Schenectady, N. Y. App. filed Aug. 2, 1902. Details of an attachment plug which may be turned freely in the lamp socket without twisting the wires.

740,973. SYSTEM OF ELECTRICAL DISTRIBUTION; Albert E. Doman, Elbridge, N. Y. App. filed May 31, 1902. An electro-magnetic device for automatically directing current through a storage battery or around it, depending upon the voltage of the circuit.